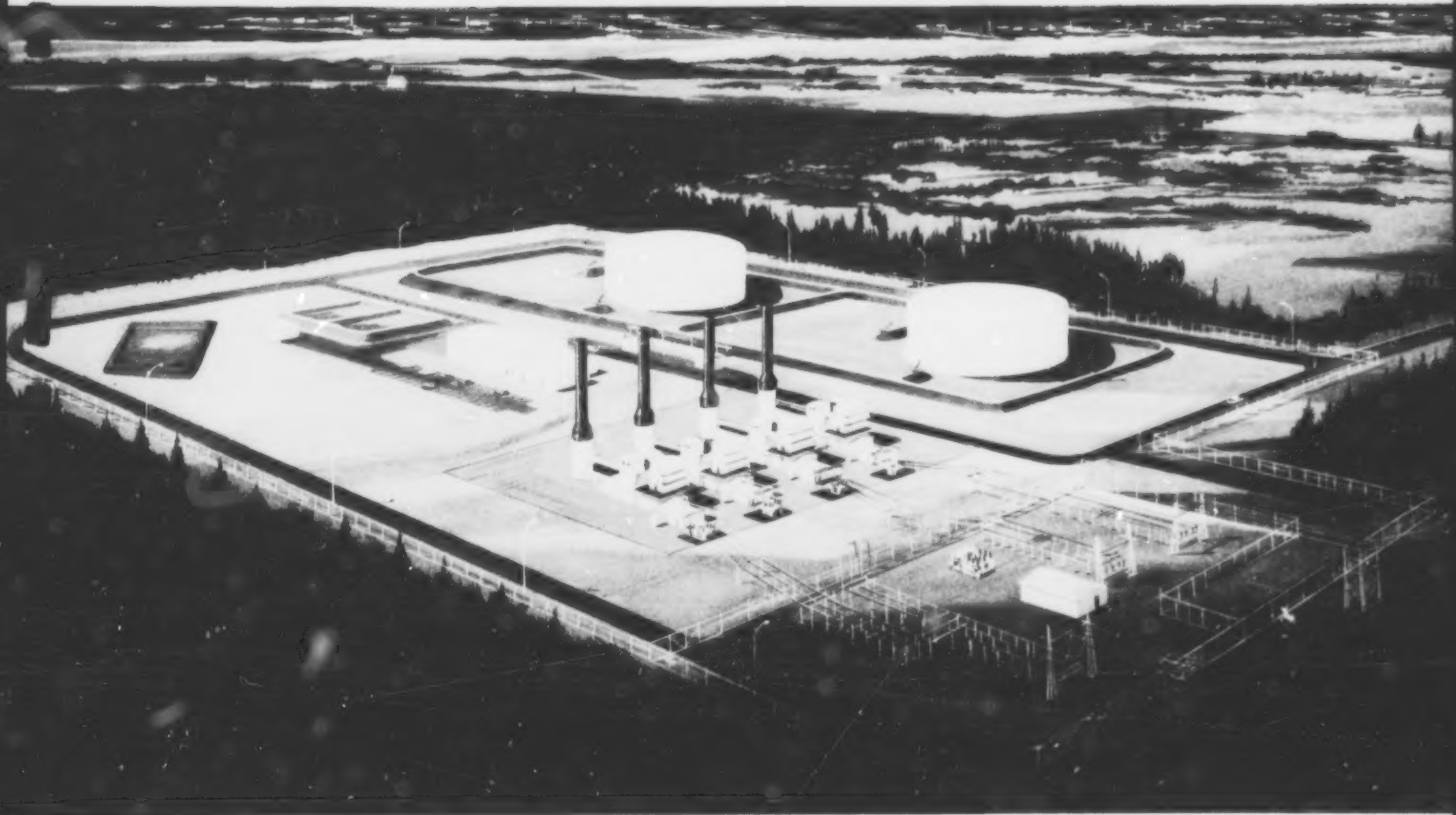
MILLBANK

400 MW COMBUSTION TURBINE
GENERATING STATION



ENVIRONMENTAL IMPACT ASSESSMENT

FINAL REPORT

NB POWER

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APPENDIX C - CONTINGENCY PLAN

FOREWORD

This document was prepared by NB Power with the assistance of its consultants. NB Power was solely responsible for Section 2.0, Introduction, and also prepared Section 3.0, Project Description, in conjunction with Monenco Consultants Limited of Fredericton, New Brunswick. Section 4.0, Biophysical Setting, was prepared jointly by Monenco Consultants Limited and Concord Scientific Corporation of Toronto, Ontario. Groundwater investigations and sound level studies were carried out by Maritime Groundwater Inc. of Fredericton and Barman Swallow Associates of Rexdale, Ontario, respectively, under subcontract to Monenco Consultants Limited. Section 5.0, Socioeconomic Setting, was prepared by WMS Associates Ltd. of Fredericton, New Brunswick. Sections 6.0 and 7.0, Construction Phase Effects and Operational Phase Effects, represent joint efforts of NB Power and all consultants. NB Power and Monenco Consultants Limited were responsible for Section 8.0, Decommissioning and Abandonment Phase, and for Section 9.0, Monitoring Program, together with Concord Scientific Corporation. Section 10.0, Public Consultation, was prepared by NB Power and WMS Associates Ltd.

CHAPTER ONE

SUMMARY AND CONCLUSIONS

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1.0 SUMMARY AND CONCLUSIONS 1

1.0 SUMMARY AND CONCLUSIONS

In late 1989, the opportunity arose for NB Power to sell 400 MW of peaking power to Hydro Quebec beginning in 1991, and thereby to satisfy NB Power's future peaking requirements and its objective of utilizing the tie-lines between New Brunswick and Quebec for import/export business. Combustion turbine generating units are the only technology which could be built in time to take advantage of this opportunity. The capacity would be recovered over the twenty year contract to meet NB Power's in-province demands, at depreciated cost and at a rate compatible with projected system growth. It would yield financial benefits in the range of $180 to $230 million, and would significantly augment NB Power's system reliability at very low cost.

NB Power's overall system requirements dictated that the proposed plant be located in northeastern New Brunswick. A number of sites were investigated according to the criteria of adequate raw land availability, availability of freshwater supply, proximity to a wharf in navigable waters, proximity to the existing transmission grid, and proximity to major transportation routes. The Millbank site satisfied all criteria.

The proposed Millbank Combustion Turbine Project will consist of four 100 MW (nominal) diesel fuelled turbines and auxiliary facilities located at Millbank, approximately six kilometres north of the Town of Chatham on Route 11. The site property consists of approximately 269 ha of undeveloped land. Of this total, approximately 246 ha will remain as an undisturbed buffer around the actual facilities. Twenty three hectares will be developed and will provide space for the turbine units, two fuel storage tanks, a water supply/fire protection reservoir, a switchyard and a water treatment/maintenance building.

A short transmission line will connect the Millbank generating station to the existing power grid.

This Environmental Impact Assessment deals with the construction, operation and decommissioning of the plant. The assessment was based spatially in an area of 50 km surrounding the plant. Investigations included potential impacts on groundwater, local airshed and of noise during construction and operation. Socioeconomic impacts are also discussed.

The Millbank station will require up to 66 L/s of water for emission controls and plant services. This will be supplied by a well field located near the station. Groundwater investigations were undertaken to ascertain aquifer yields. The three test wells drilled all showed more than adequate supply. Production ranged from 11 L/s to over 27 L/s. Local residential wells were also surveyed and water samples analyzed. While it is expected that careful spacing of the production wells adequate distances from the residential wells will result in minimal effects, NB Power will monitor drawdown effects and is committed to arranging for alternate supply if local wells are affected.

A pre-development study indicated that the sound levels are typical of rural environments. Average levels were found to be between 33 and 48 dB(A) at three test locations near the site, and were caused by local road traffic, distant rail traffic, industrial plants, wind, the airbase at Chatham and vessel traffic in the Miramichi Channel. Noise levels at the critical points of reception (nearest residences) were predicted to be 35 dB(A) and as high as 42 dB(A) when downwind/inversion weather occurred. These levels can be compared to those found in a "quiet" library. Construction noise, because of its characteristics and timing, will not exceed those levels that currently occur from traffic in the area.

The fuel for the combustion turbine units will be No. 2 diesel, the only fuel available in New Brunswick for this type of unit. This fuel, in concert with the design of the units, serves to control emissions at source. Sulphur dioxide and particulate emissions associated with this fuel are low, and require no specific control measures; nitrogen oxide emissions are minimized through the use of a water injection system. Emission rates will be less than the Environment Canada guidelines of 0.6 lb/per million BTU for SO_2, 0.3 lb per million BTU for NO_x, and 0.1 lb per million BTU for particulates.

The impacts of emissions from the proposed TGS were determined by using air quality dispersion models. These models predicted the short term and long term air quality levels as a result of emissions from existing and proposed sources in the airshed. Short term predictions of 1 hr, 24 hr and annual average concentrations indicate the maximum SO_2, NO_2 and Total Suspended Particulate concentrations due solely to the proposed TGS would be below the corresponding New Brunswick standards. Using 5 yrs of weather data from the Chatham Airport, maximum ground level concentrations of SO_2 and NO_2 due to the proposed TGS were predicted to be 232 and 116 $\mu g/m^3$, compared with the New Brunswick standards of 900 and 400 $\mu g/m^3$, respectively.

Predicted wet deposition levels due to the proposed TGS together with other sources and including current background deposition are well below levels considered adequate to protect the most sensitive aquatic habitat, namely, 14 kg SO_4/ha/yr.

The potential for impacts on sensitive receptors (human population, vegetation, aquatic system and wildlife) in the airshed is therefore negligible.

The proposed facility will emit an estimated 0.15 million tonnes per year of CO_2, compared to a total provincial annual emission of 19.4 million tonnes per year from all sources including industrial, transportation, utilities, commercial and residential.

The construction and operation of the proposed Millbank TGS is expected to affect the socioeconomic environment of the area in immediate proximity to the plant, the Chatham/Newcastle area and the Province of New Brunswick.

Issues of concern to residents in immediate proximity to the proposed project are the possibility of a diminished quality of life and the potential of a decrease in property values.

Local residents will experience increased nighttime noise levels during plant operation between the hours of 7:00 PM and 10:00 PM, when ambient noise levels are lower than during daytime hours. Water quantity and quality is not anticipated to change as a result of the operation of the Millbank TGS. Emissions from the operation of the facility including emission levels in the immediate area will be minimal and will not pose a problem to human health or resource harvesting.

The Millbank TGS will be visible on the horizon and from some residences in the immediate area. The plant is set back from Routes 8 and 11 in an area with extensive tree cover which minimizes its visual intrusion.

Property values in the area (specifically in the Rockcliffe subdivision) are not expected to be adversely affected by the Millbank TGS because no significant adverse environmental or social impacts are anticipated.

Construction traffic is expected to cause a temporary increase in congestion on Route 11. There will be a slight increase in accident potential. Tankers delivering fuel to the site will produce a small increase in traffic on the delivery routes and increase the potential of an accidental spill of diesel fuel. Areas of sensitivity for ground and surface water are identified and a contingency plan for accidental spills will be in place.

Health risks are not expected to increase as a result of the transmission of power from the Millbank TGS.

The small incremental demands on community services resulting from the construction and operation of the Millbank TGS are within the capacity of existing services. A positive impact on the local tax base is anticipated.

Positive effects on the Provincial labour force are anticipated from the construction and, to a lesser extent, operational phase of the project. Positive effects on the Provincial economy and on the economic base in the Chatham/Newcastle area are anticipated.

CHAPTER TWO

PROJECT DESCRIPTION

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2.0 INTRODUCTION

2.1 Purpose of the Environmental Impact Assessment

The purpose of the Environmental Impact Assessment is, simply put, to ensure that the Millbank Combustion Turbine Project is implemented in an environmentally sound manner. The EIA's prime objective is to ensure that a project will be implemented in a way which will sustain the environment in which it is developed. The EIA allows for the early identification of environmental and socioeconomic factors which are potentially placed at risk by the proposed project, and identifies the opportunity for appropriate mitigation. It acts, in effect, as an "early warning system" which will allow the public to participate in the identification of issues, the designers at the conceptual level to incorporate measures to eliminate or minimize potential issues, the decision makers to rule on the acceptability of the project and to define conditions according to which it can proceed, and the regulators and operators to design appropriate means to measure the environmental performance of the plants and to monitor the receiving environment where necessary.

The EIA for the Millbank project is a result of the registration and screening of the proposed undertaking under the terms of the Environmental Impact Assessment Regulation of the New Brunswick Clean Environment Act.

2.2 The Proposed Undertaking

NB Power proposes to construct a thermal generating station at Millbank, New Brunswick, on the northern shore of the Miramichi River across from the Chatham Generating Station. The proposed plant is to consist of four (4) 100 MW combustion turbine units, to be fuelled with No. 2 diesel oil. The plant will include on-site fuel storage tanks, a stand-alone water supply, a switchyard, and transmission facilities to connect with the existing NB Power grid.

The proposed Millbank Thermal Generating Station (TGS) will be operated as a peaking unit, with an expected utilization of 500 hours per year or an annual capacity factor of about 6 percent. Under normal system conditions it is anticipated that the station will be used in the winter months of November to February. It is also possible that the plant would be used on an emergency basis should there be a major disruption to the NB Power system such as the loss of the Point Lepreau Generating Station. There is a low probability, depending on the in-province and Hydro Quebec demands, and the operational status of the two systems, that these units would not be called upon at all in a given year. They would be available as operating reserve in such a situation, and would contribute to the reliability of the two systems. The Millbank TGS is intended to be in commercial service by 1 November 1991, and it is intended to have a working life of 20 years.

Details of the site and the project are discussed in Chapter Three.

2.3 Project Rationale

2.3.1 NB Power System Background

The New Brunswick Electric Power Commission (NB Power) is a crown corporation established in 1920 "to provide for the continuous supply of energy adequate for the needs and future development of the Province and to promote economy and efficiency in the generation, distribution, supply, sale and use of power". The utility grew at a modest rate during its first half century; then, during the 1970s, it embarked on a major expansion program. This program involved the construction of a number of large generating units, including Atlantic Canada's first nuclear powered station, and the development of a series of strong interconnections with neighbouring utilities. The benefits of this program to NB Power were two-fold: it was able to realize economies of scale by investing in large units, and it was able to take advantage of a unique geographic position to improve energy cost to its customers in New Brunswick. In so doing NB Power pioneered the concept of building generating capacity in advance of domestic requirements, or "prebuilding". The financial exposure of NB Power, and hence the risk to its domestic customers was at the same time limited through the innovation of "all-events" contracts with export customers.

Today, NB Power is a diversified medium-sized utility. The installed capacity of the utility is 3220 megawatts (MW), supplied by hydro (26 percent), nuclear (20 percent) and conventional thermal plants (54 percent). The utility services some 303, 000 customers in New Brunswick either directly or indirectly, and carries out interchange transactions with the New England States, Québec, Nova Scotia and Prince Edward Island. In the fiscal year ending March 31, 1989, combined in-province generation and purchases totalled in excess of 19.3 billion kW hours with 15.9 billion kW hours supplied by NB Power generation and the remaining 3.4 billion kW hours supplied by purchases. Exports made up of both firm and interruptible sales to neighbouring utilities totalled 5.9 billion kW hours.

The electrical demand in New Brunswick is made up of a number of sectors. The industrial sector is the largest component, or about 45 percent of the total. The forest industry, which typically accounts for 65 to 75 percent of all industrial usage, is the largest of the industry group followed by mining. These power intensive industries account for a higher proportion of NB Power's total load than is the case for most utilities. Consequently, NB Power's energy demand is relatively constant during most hours of the day due to the 24 hour - 7 day week nature of its industrial base.

On an annual basis, however, large swings in energy demand occur. Peak energy demands are imposed during the winter months mainly due to the increased use of electric space and water heating. Energy consumption, for example, in the month of July is typically about 60 percent of the consumption in January. Peak demand for July and January proportionally have the same relationship. Figure 2-1 shows the forecast monthly consumption for 1989/90 on a per unitized basis.

This phenomena is typical of utilities in northern latitudes and is especially true where electric heating is prevalent.

One of the implications of seasonally cyclical load is that it requires generation which has to run only during the peak periods as opposed to base load which must be served during every hour of the year. Electrical utilities typically install peaking hydro or combustion turbines to fulfil peaking requirements in the 0 - 20 percent capacity factor range and intermediate capacity in the form of hydro or fossil-fired steam or combined cycle units for needs in the 20 - 70 percent capacity factor range. Base load hydro, coal, and nuclear capacity are normally utilized for capacity factors in excess of 70 percent.

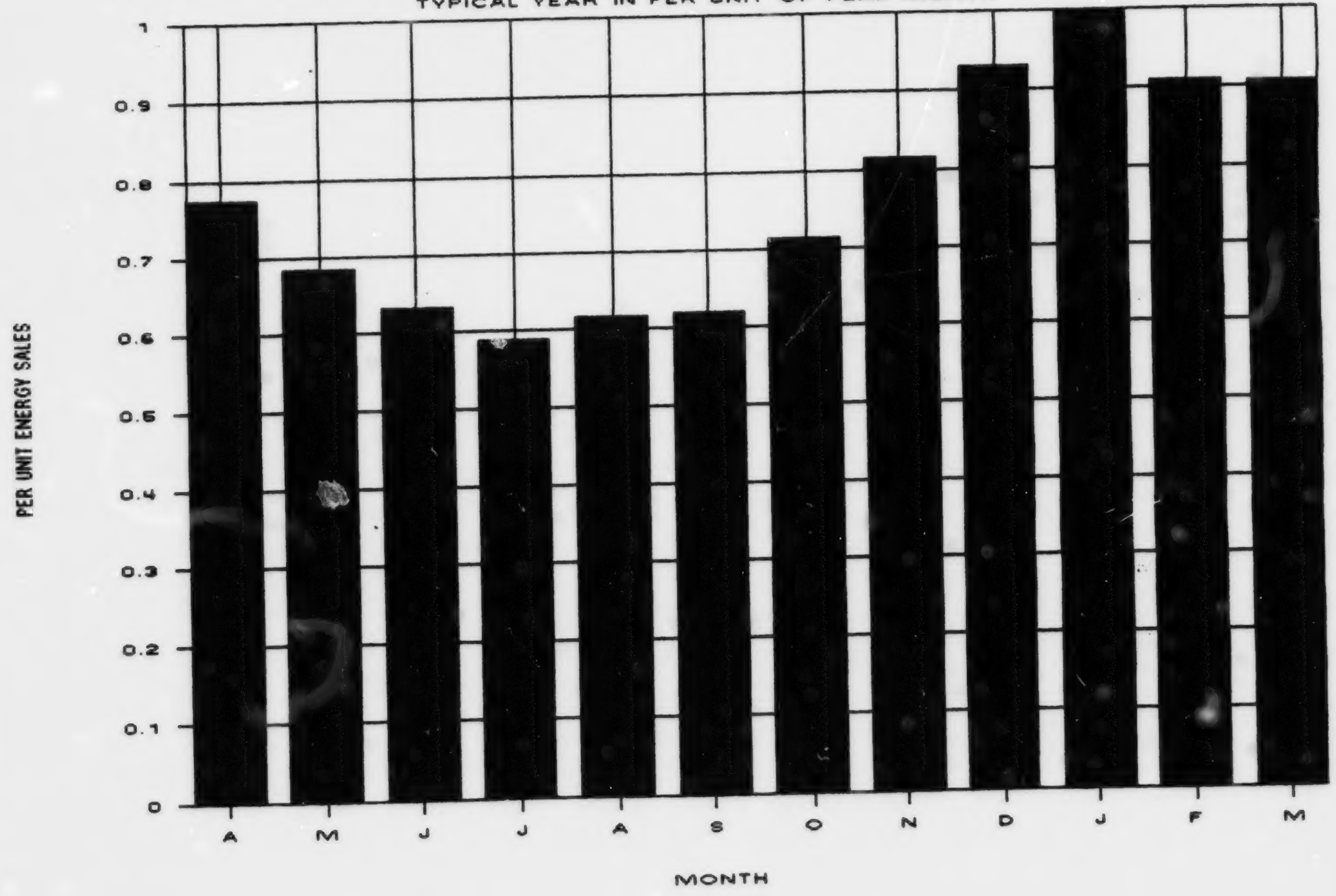
NB Power presently has a large portion of its capacity in relatively efficient conventional steam plants (i.e., heat rates $\leq$10,000 BTU/kWh). Of the total 1725 MW of thermal capacity, in excess of 90 percent was originally built as base load plant. The most efficient of these units now serve as base and intermediate capacity while the older, less efficient plants operate only during peak periods.

NB Power's forecast growth necessitates the addition of new capacity in the 1990s. Studies have shown that a base load coal unit is the most economical choice for the initial addition. This project is now under construction in Belledune and is scheduled for an in-service date in 1993/94.

Further capacity additions are required beginning as early as 1996 and are expected to be met by the addition of a second coal-fired unit before the end of the decade. Beyond this requirement, there will likely be a need for additional capacity on the system which can be most economically met through the addition of combustion turbine peaking units.

FIGURE 2–1
NB POWER MONTHLY ENERGY CONSUMPTION

TYPICAL YEAR IN PER UNIT OF PEAK MONTH



2.3.2 Proposed Export Contract

As a result of plans to meet NB Power's future needs for peaking capacity as economically as possible, and in keeping with on-going efforts to utilize the province's inter-utility tielines for import/export business, the opportunity has arisen for NB Power to sell 400 MW of peaking power to Hydro Québec which has a need for additional peaking capacity starting in 1991. In order to meet this requirement, the utility is planning to install numerous combustion turbines.

Hydro Québec and NB Power investigated the possibilities of a peaking capacity sale of 400 MW by NB Power. Negotiations culminated with a letter of intent consisting of the following terms and quantities:

400 MW - November 1, 1991 to October 31, 1998
300 MW - November 1, 1998 to October 31, 2002
200 MW - November 1, 2002 to October 31, 2011

The contract thus allows NB Power to recover part of the capacity when required in the late 1990s and the remainder when the system is large enough to accommodate it.

Combustion Turbines were selected for this project as specified in negotiations with Hydro Québec. The pricing structure of the contract and the payment terms for capacity are tied to the construction of these units. In addition, combustion turbines are considered to be the least expensive option for peaking capacity. The capital cost for these units averages some 25 to 30 percent of the capital cost for a comparable base load unit. The tradeoff is that combustion turbines are designed to burn high quality fuel oil which are typically up to twice as expensive as lower grade fuel oils. The combination of these two characteristics makes combustion turbines economic for peaking operations which require limited fuel usage.

Short lead times for construction also aid to the attractiveness of combustion turbines since they typically can be constructed in less than one half the time of a base or intermediate plant.

The only other fuel which is presently used extensively for combustion turbines is natural gas. New Brunswick presently does not have this option and therefore NB Power has selected the only other proven and available fuel, No. 2 diesel.

2.3.3 Contract Benefits

The financial benefits of the proposed sale to Hydro Québec are estimated to be between $180 and $230 million over the 20 year term of the contract. This results from the sale of capacity at a levelized charge rate of $105/kW-year for capacity which is in service by November 1, 1991 or $100/kW-year for capacity in service later than November 1, 1991. Energy benefits are calculated based on a 10 percent profit margin. A major benefit of the contract allows recovery of capacity to serve New Brunswick load in case of generation shortages. This added proviso will significantly add to the reliability of NB Power's system at very low cost. The sharing of reserve capacity will benefit the customers of both utilities by increasing the overall quantity of standby operating capacity available to both systems.

The phased repatriation of capacity in 1998, 2002 and 2011 will bring the capacity back to NB Power's system when required, at depreciated cost, and at a rate which is compatible with projected system growth. Figure 2-2 shows the structure of the proposed export as it relates to both Hydro Québec and the phased recovery of capacity on NB Power's system.

When placed in the context of NB Power's overall development plan, the project meshes with the need for new generation thus ensuring a good match of load and reserve requirements to installed capacity. Figure 2-3 shows the repatriated capacity from this project in context with forecast load and reserve requirements, present committed generation projects, and forecast retirements over the next 30 years.

2.4 Project Alternatives

2.4.1 Alternative Generation

The only viable alternative to the proposed project would be to forego the proposed export contract and cancel the project. All other alternatives that could be considered would either not meet the schedule proposed in the contract or the proposed pricing structure of the contract.

Combustion turbines are the only generating projects with a time schedule in the 18 months to 2 year period such that an in-service date of November 1991 could possibly be met. To forego the contract would mean a delay in construction of the project until the late 1990s resulting in escalated costs. Cancellation of the project, of course, would mean foregoing the project's financial and reliability benefits.

Combustion turbines are ideally suited for meeting peak demand in that the capital cost of the units is relatively inexpensive compared to base or intermediate load units. Conversely, the fuel cost for these units is higher than for base or intermediate load units. This combination typically makes the total unit energy costs of combustion turbines less than other options for capacity factors of less than 20 percent. Because expected operation is in this range, unit efficiency has a lower impact on total cost. These units have heat rates ranging from 10,000 BTU/kWh to 13,000 BTU/kWh as compared to base load units which are normally in the 9300 -10,000 range. The large 100 MW units for the Millbank project are some of the most efficient simple cycle combustion turbine units.

FIGURE 2-2
MILLBANK COMBUSTION TURBINE PROJECT

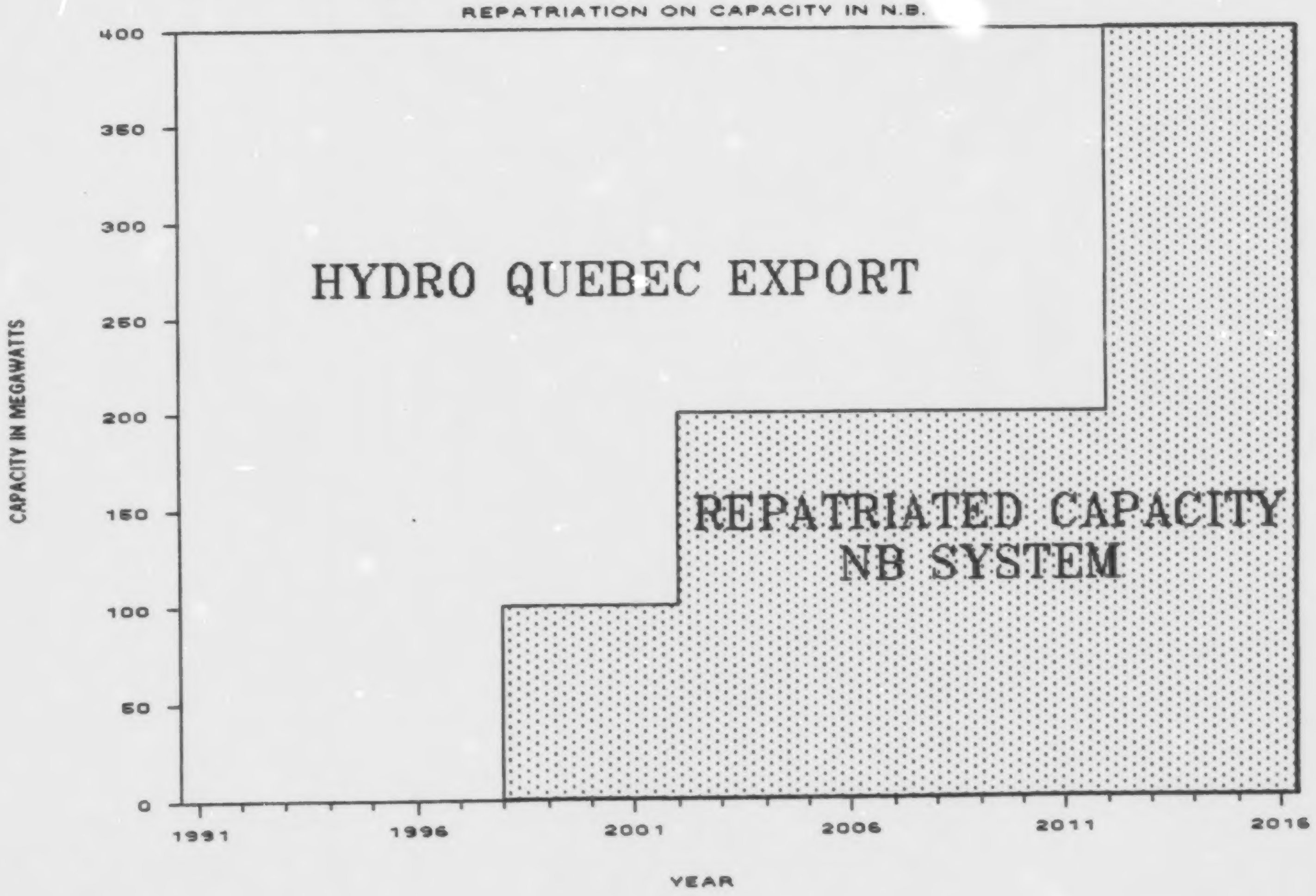
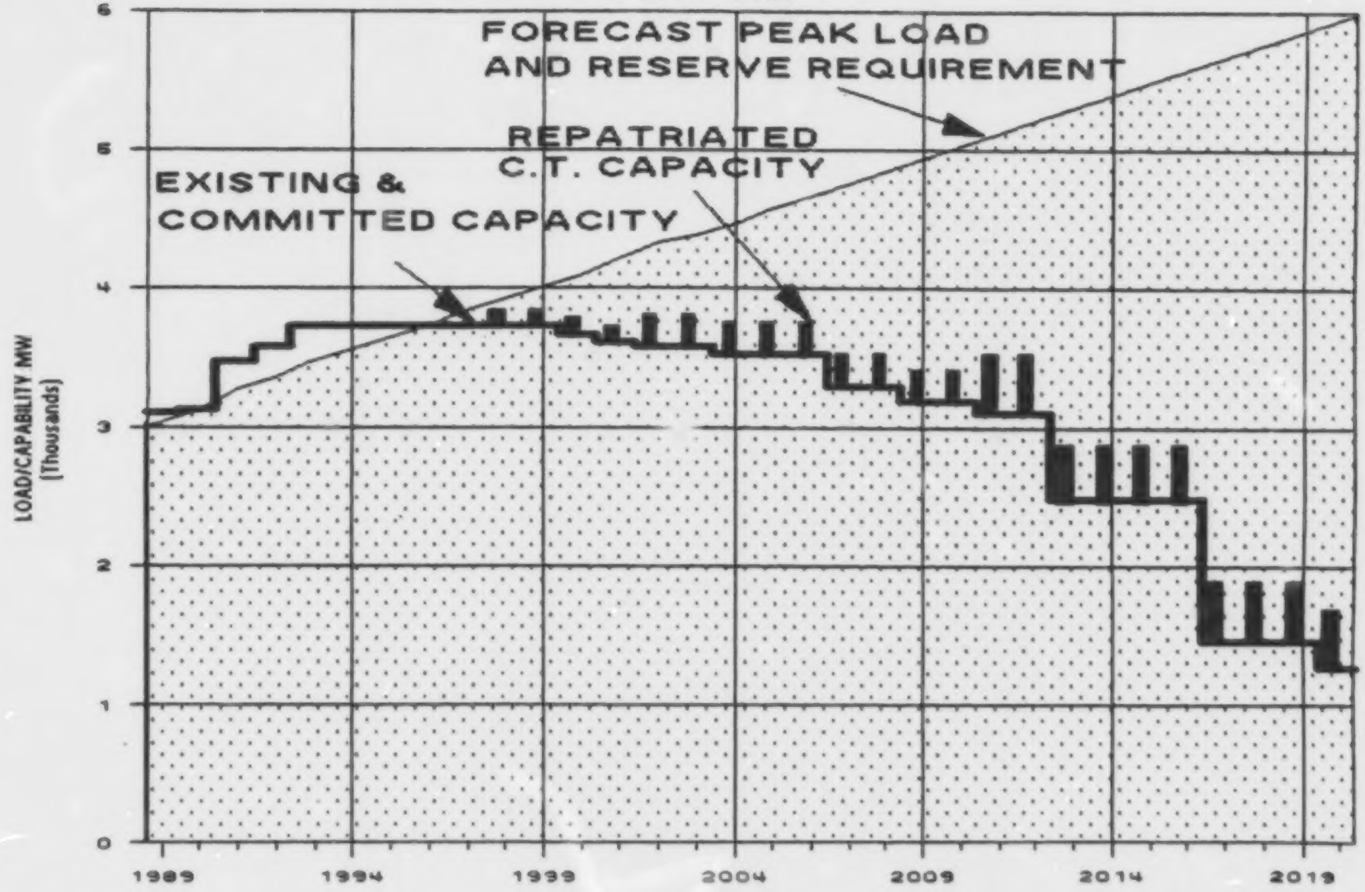


FIGURE 2–3

NB POWER LOAD AND RESOURCES

1989 - 2020



2.4.2 Energy Efficiency and Conservation

NB Power has as a stated objective the implementation of energy efficiency and conservation measures to make the best possible use of the Province's energy resources.

NB Power anticipates continued growth in electrical demand during the next decade which will necessitate the construction of new generating facilities. It plans to use energy efficiency and conservation measures to maximize existing energy production and reduce in-province demand growth. Activities that reduce electrical demand are also indirectly favourable to the environment, in that they contribute to a reduction in needed generation capacity and consequently, a reduction in the emissions resulting from that generation.

Energy efficiency is defined as the provision of the same or better electrical service using less energy. In the residential sector, cost savings can be realized from more efficient space and water heating, home insulation, and energy efficient appliances and lighting. In the industrial sector, major cost saving opportunities exist in electrical load management, waste heat recovery, use of heat pumps, cogeneration, and improved efficiency and high efficiency electric motors.

Energy conservation is realized through the wise use of energy and the elimination of waste. Awareness is the key component of NB Power's energy conservation programs. Specifically targeted information programs are planned to change attitudes toward energy waste. Overall objectives will be directed toward:

- Developing NB Power's own skills and knowledge in energy efficiency and conservation to provide better advice and assistance to customers;

- Developing customer knowledge of the value of wise energy use through information programs;

- Participating with other provincial government departments to establish standards for energy efficient construction for new commercial and industrial buildings;

- Encouraging energy efficiency in new and major retrofits to commercial and industrial buildings through technical design assistance and incentive programs; and

- Participating with all levels of government to urge minimum performance standards on major household appliances.

On the more tangible side, NB Power has implemented a three-year street light conversion program, whereby some 60,000 street and area lights will be converted to a more efficient high pressure sodium type. This measure is expected to decrease the growth rate in street light energy sales to 1 percent per year from 4 percent per year.

A number of programs are envisaged under the umbrella of an "Energy Wise" strategy. This has begun with Home Energy Checks, whereby Energy Advisors visit customers' homes to provide advice on how energy can be used more efficiently. This will be followed by the Energy Wise Street and Area Lighting Program. We are also reviewing the utility's involvement in applying the energy wise concept to municipal facilities and are working with the New Brunswick Home Builder's Association in promoting the R-2000 Program.

NB Power also provides support to a centre at the Université de Moncton for research and development, in energy conservation and certification of heating, ventilation, air conditioning and refrigeration equipment.

To help implement the Energy Wise strategy and related energy efficiency and conservation measures, Energy Advisors have been located in each District Office to provide information and to help customers make informed decisions.

As its initial objective, NB Power hopes to reduce in-province demand growth by 10 percent per year through the above energy efficiency and conservation measures.

More details of these various initiatives, and a summary of historical efforts in this area, may be found in the document entitled "NB Power's Participation in Energy Conservation" (Jan., 1990).

NB Power has also embarked on a program of demand management. Included is a curtailable load program for large industry which will enable reduction of industrial loads during peak periods. NB Power has recently signed a contract for some 20 MW of this type of load.

Planning studies for load and supply alternatives are ongoing. Future plans for meeting load will incorporate an integration of the most economic projects for both load reduction and power supply. The methodologies and techniques used in the dynamic planning exercise will be included in presentations to the Public Utilities Board of New Brunswick at future public hearings.

Based upon the results of these studies, load management projects which prove economic will be implemented through specific program design where necessary, with financial incentives. Power supply options, on the other hand, will include conventional resources along with new alternatives, including non-utility options, which prove to be reliable and economic. Focus will also be given to provincial renewable resources through appropriate purchase policies for non-utility generators.

Although peak-sharing options do not typically result in large benefits, they also will be examined. NB Power's energy limited hydro system minimizes the benefit of this sort of program.

2.5 Project Location

2.5.1 Site Selection

The site for the proposed Millbank TGS was selected according to a number of criteria.

The first consideration was to locate the facility in such a way as to optimize the benefit to the NB Power system of the addition of this capacity. Overall system requirements dictated that the proposed plant should be located within the northeastern quadrant of the Province. This was due to the significant benefit the plant would provide in terms of security of supply and voltage support to the northeast, thereby substantially increasing the reliability to this somewhat vulnerable area.

Within the northeastern portion of the Province, five other criteria were used to identify and screen possible sites; these were:

- availability of a large block of raw land of approximately 150-200 ha, suitable for construction purposes in terms of slope, drainage, and foundation conditions;
- availability of a freshwater supply to be used primarily in the NO_x emission control system for the units, while avoiding protected watersheds;
- proximity to a wharf in navigable waters capable of accepting coastal size oil tankers for fuel delivery, assuming that fuel delivery by sea would be the economic means of fuelling the plant;

- reasonable distance from the existing transmission line grid, to allow for ready interconnection into the system; and

- proximity to major surface transportation routes capable of accepting heavy loads (i.e., many bridges are limiting).

The coast line of the Miramichi estuary as far north as Shippagan was investigated, but offered no harbours which would be ice-free and have sufficient depth to accommodate marine delivery of fuel.

NB Power's property at Belledune, currently the site of construction of a 450 MW coal fired thermal unit, was considered due to its year-round shipping facilities and the availability of suitable land. However, this site was eventually discounted due to the severe logistical complications which would occur by attempting to have two major and completely unconnected construction projects underway concurrently, and the serious risks of schedule disruptions which could result for one or both projects.

The Chatham Generating Station site was also considered for the facility. However, the four unit configuration of the proposed facility could not be accommodated on the available land at the Chatham Generating Station.

Both the Canadian Forces Base Chatham and the St. Margarets Radar Base were considered, as indications were that sufficient land might be available. Both sites were eventually discarded due to the distances from marine shipping facilities and the consequent high cost of pipeline construction and pumping of fuel to site.

Morrison Cove on the northern shore of the Miramichi River upstream from Millbank was also considered, due to the presence of a wharf at the nearby Northwood Panel Board Plant. This site was eventually discarded due to the limited amount of land available.

The proposed Millbank site was eventually selected as it satisfied all necessary criteria which had been established. It satisfied very effectively the requirements of the NB Power generation and transmission system, and it was in close proximity to existing 138 kV and 230 kV transmission lines. An appropriately sized block of raw land was available; options were readily agreed to by owners of contiguous parcels of land totalling some 160 ha, thus providing a suitable area of some 23 ha for the facility and the remainder to form a buffer zone for attenuation of operational noise and for visual screening to the extent possible. The land was suitable for construction purposes, and a test well at NB Power's nearby substation on the McHardy Road was indicative of a plentiful groundwater supply.

Finally, the Millbank site was some 1.5 km from an existing wharf which had been used for the marine delivery of fuel. Although the facility has not been used for this purpose for several years (the adjacent Metro Fuels tank farm is no longer utilized), preliminary indications were that the wharf could be readily renovated to again accept such fuel deliveries.

The Millbank site is described in detail in Section 3.1 below.

2.5.2 Changing Considerations

The marine delivery of fuel to the Miramichi estuary (i.e., ship delivery of diesel oil, transfer and pipeline to the site) which formed such an important consideration in the original selection of the Millbank site, is no longer a practical plan and has been eliminated from the project.

The reasons for this are two-fold. First, detailed examination of the existing wharf indicated the need for extensive remedial work to bring it up to the required Transport Canada standard, and this work could not be completed in time to meet the project in-service date. Secondly, when the alternative fuel delivery system of tanker truck delivery from a regional refinery (Saint John, Dartmouth) was investigated, it became apparent that delivery by this means could be achieved efficiently and at considerably lower cost, due to the high cost of the necessary wharf renovations, the pipeline and associated pumps, and their operation.

2.6 Regulations and Codes of Practice

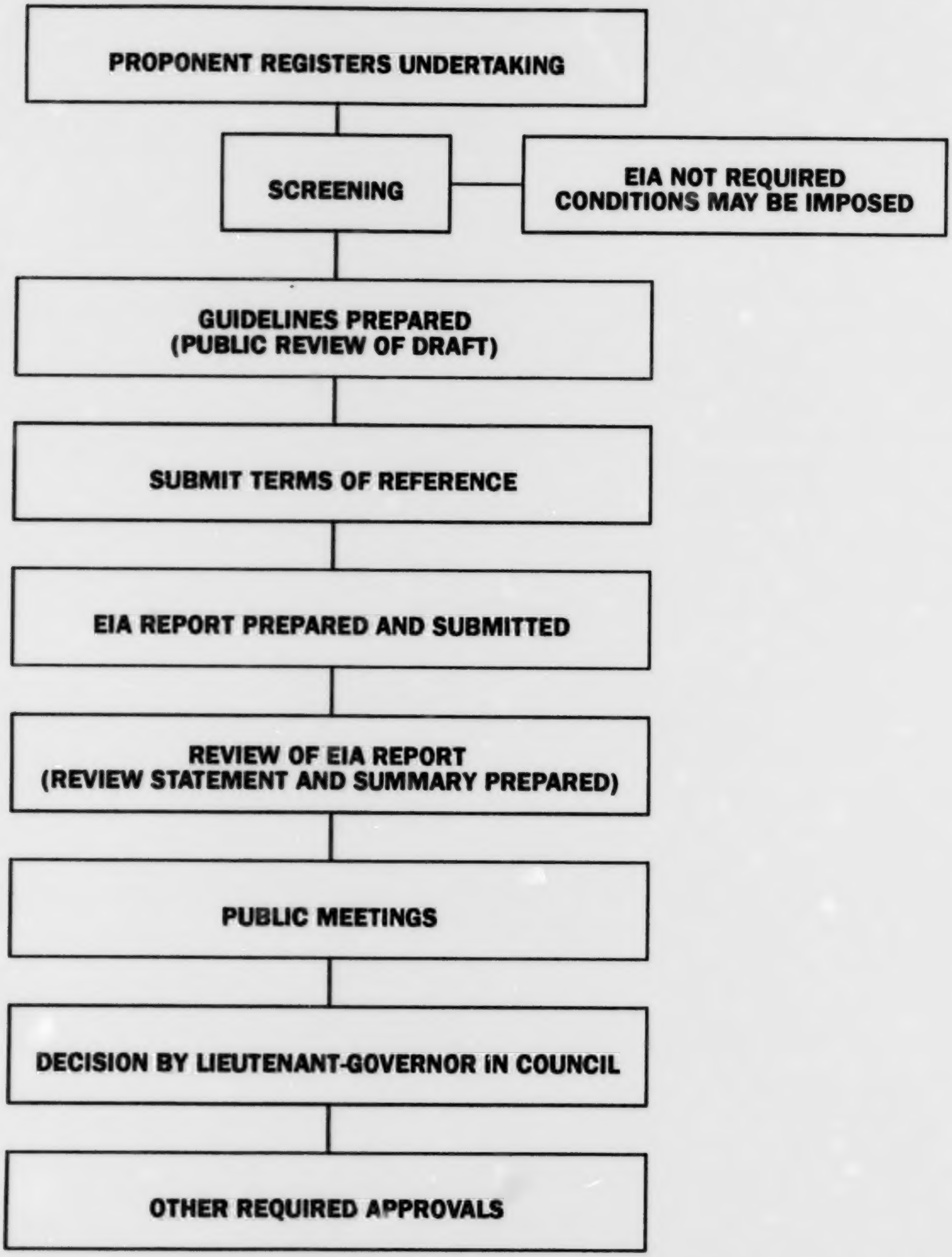
The proposed generating station will be required to meet applicable provincial and federal regulations and guidelines. This environmental impact assessment report is intended to meet the requirements of New Brunswick's Environmental Impact Assessment Regulation within the terms of the Clean Environment Act. The assessment process is supervised by a steering committee, coordinated by the NB Department of the Environment and consisting of representatives of various provincial and federal departments. The assessment process will lead to a decision as to whether or not the project should proceed, and, if allowed to proceed, under what conditions. Details of the entire process are shown in Figure 2-4.

If the project is allowed to proceed, then application for "Approvals to Construct and Operate" will be required under the Province's Clean Environment Act (New Brunswick Department of the Environment Air Quality Regulation 83-208, 1989 and Water Quality Regulation 82-126, 1986). These regulations specify particular standards for various effluents and other emissions, and provide an opportunity to ensure that proposed waste management technology will be adequate to achieve stated objectives.

NB Power has recently formally advised Environment Canada that it would apply the Environmental Codes of Practice, including the Site Selection, Design, and Construction Phases, to all new steam electric power plants undertaken in the future. NB Power is the first utility in Canada to make such a commitment to the use of the Codes which are the result of a federal/provincial/industry task force and are intended for application to steam electric generating stations.

FIGURE 2 - 4

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
NEW BRUNSWICK


PROPONENT REGISTERS UNDERTAKING
SCREENING
EIA NOT REQUIRED
CONDITIONS MAY BE IMPOSED
GUIDELINES PREPARED
(PUBLIC REVIEW OF DRAFT)
SUBMIT TERMS OF REFERENCE
EIA REPORT PREPARED AND SUBMITTED
REVIEW OF EIA REPORT
(REVIEW STATEMENT AND SUMMARY PREPARED)
PUBLIC MEETINGS
DECISION BY LIEUTENANT-GOVERNOR IN COUNCIL
OTHER REQUIRED APPROVALS

Although the present project is not a steam electric generating station, where applicable the Codes have been utilized. The review for consistency with the Siting Phase Code is given in Appendix A; the review of Design Phase Code is given in Appendix B; the Construction Phase Code will be reviewed immediately following approval of the EIA, if and when this occurs.

During the summer of 1989, the Federal Government advertised its intention to consult with stakeholders on a plan to manage Nitrogen Oxides and Volatile Organic Compounds in Canada. Consultation formally began with Technical Briefings in Calgary and Montreal during August 1989 followed by a three-day Workshop in Ottawa during September. At the Workshop, several Work Groups were formed to carry out recommendations developed at the Workshop to gather more information and prepare reports for input to the plan.

The reports were submitted to the Federal Government by early 1990 and used by the Government to supplement their other data in preparation of a draft Management Plan. This draft Plan was released in March 1990 and was followed by another Workshop in Ottawa during April 1990. Suggestions by various stakeholders as to how the Plan could be improved were provided to the Federal Government at the Workshop and following the Workshop as late as June 1990.

The draft Plan released in March 1990 discusses possible NO_x and VOC reductions by various fuels, technologies, sectors, regions, etc. However, the content of the final Plan will not be available to stakeholders until the fall of 1990. It first has to be submitted to the Canadian Council of Ministers of the Environment (CCME) for their review during the early fall of 1990. Contingent on their approval, it will then be released to stakeholders.

The draft Plan contains New Source Performance Standards for Stationary Gas-Fired Turbines to be effective in 1994. The draft Plan did not contain a specific initiative to address combustion turbines fired with oil and used as peaking units as, for example, the

Millbank Units. During the design of the Millbank Units for NO_x control, this Plan was still in the development stage. Thus, design NO_x emission limits for the Millbank Units were based on the most stringent applicable Canadian standards available at the time the units were designed, specifically "Thermal Power Generation Emissions-National Guidelines for New Stationary Sources (Environment Canada, 1981)."

2.7 Project and EIA Schedule

The opportunity to realize the benefits of this combustion turbine project was first recognized in mid-December 1989. At this time, site selection and conceptual engineering activities began. The project was registered as an undertaking with the New Brunswick Department of the Environment on 1 February 1990, in keeping with the terms of the Environmental Impact Regulation of the Clean Environment Act. NB Power was advised that an Environmental Impact Assessment (EIA) would be required on 11 February 1990, and a draft set of Guidelines for an EIA was produced by NBDOE for public review on 1 March 1990. A final set of Guidelines was produced on 1 April 1990.

The change in project concept discussed in Section 2.5 was communicated to the New Brunswick Department of the Environment at the end of April, and resulted in an amendment to the Guidelines dated 3 May 1990. As a result of that change in concept, those aspects of the Guidelines issued on 1 April 1990 dealing with the marine delivery of fuel to the Miramichi estuary (i.e., ship delivery of diesel oil, transfer and pipeline to the site, associated risk of spills and contingency plans, wharf and pipeline construction including associated dredging) have not been addressed.

The studies leading to this report were carried out over the period of mid-February to mid-May. Concurrent with these studies, project engineering and procurement activities were initiated, as was the acquisition of the desired land in the Millbank area. These and other project activities and key dates are shown on Figure 2-5.

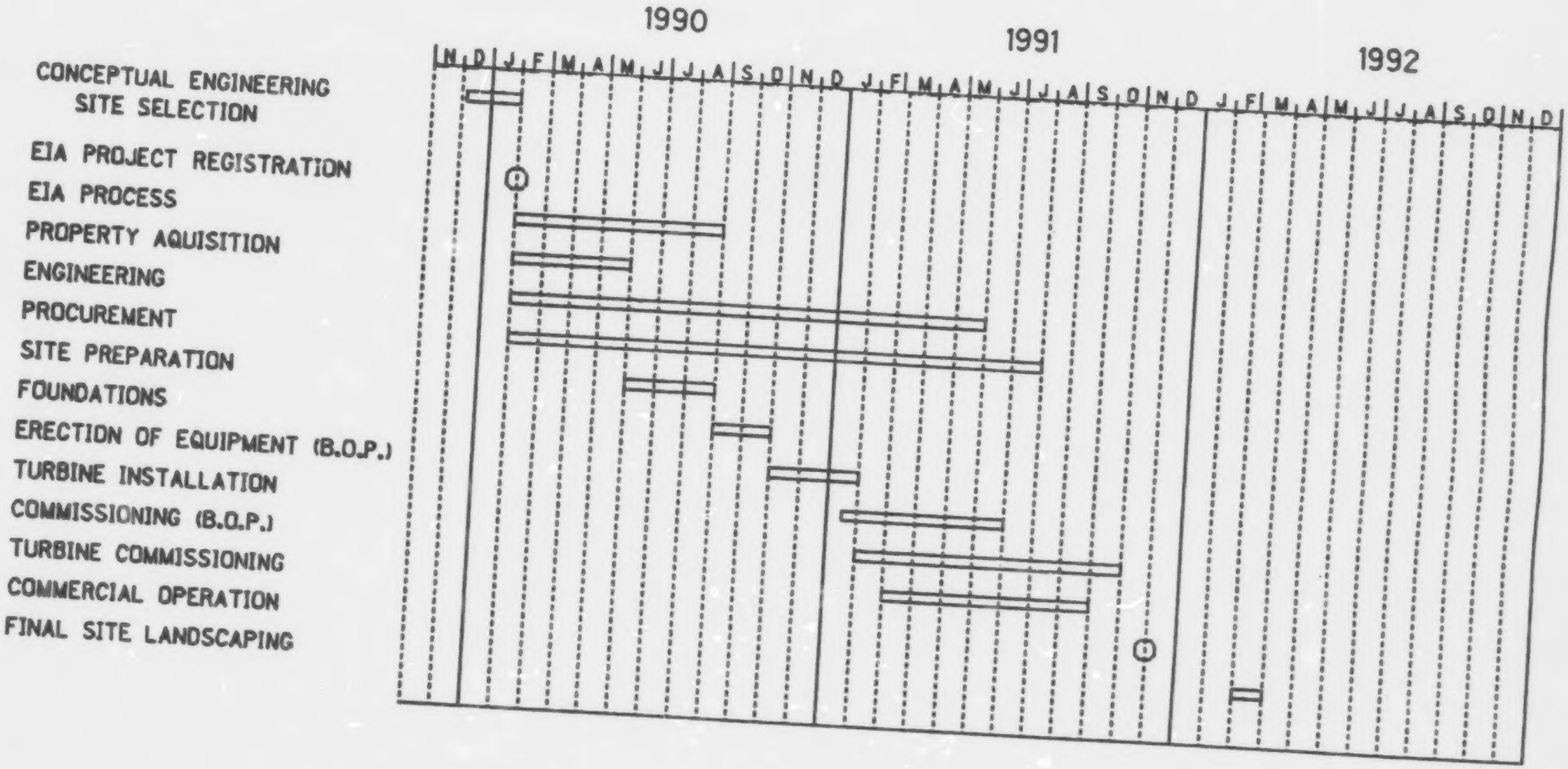
There are a number of key dates related to regulatory approvals which are worthy of note. First, the draft EIA document is to be submitted in mid-May 1990, to the New Brunswick Department of the Environment for intergovernmental review, followed by a public review period of 30 days. It is anticipated that a public meeting will be held in mid-August as a part of the public participation process. It is further anticipated that a final decision regarding the acceptability of the project will be made by Cabinet some two weeks following the public meeting.

If the project is approved under the EIA Regulation, then NB Power must obtain both an "Approval to Construct" and an "Approval to Operate" under the terms of the Clean Environment Act. It is intended that preparatory information will be submitted to the New Brunswick Department of the Environment, for purposes of initiating the application for the "Approval to Construct", by mid-June 1990. This preparatory information will be based on the draft EIA document and the current state of conceptual engineering. Preliminary designs for all systems will be submitted by mid-July, so that if EIA approval is received, then the "Approval to Construct" could be received immediately thereafter. The target date is 1 September 1990. This approval will cover the commissioning period.

NB Power must obtain the "Approval to Operate" by 1 November 1991 in order for the plant to enter commercial service. Detailed designs of all systems must be submitted by 1 August 1991 at the latest in order to ensure that this date can be achieved. Should there be a delay in obtaining this approval, NB Power would forego substantical financial and system benefits.

The project is intended to enter commercial service on 1 November 1991. It is intended that the working life of the plant will be 20 years. It is possible that this life could be

FIGURE 2-5
MILLBANK T.G.S.
OVERALL PROJECT SCHEDULE



extended, depending on such factors as the condition of the units, NB Power's internal and external energy demands, and the overall system configuration at that time. The plant would be decommissioned at the end of its working life, and it is envisaged at this time that the site would be returned to a "greenfield" condition.

CHAPTER THREE

PROJECT DESCRIPTION

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3.0 PROJECT DESCRIPTION

3.1 Location and Facilities

The proposed combustion turbine generating station (TGS) would be located north of provincial Route 11, approximately 6 km north of the Town of Chatham in the area known as Millbank (Figure 3-1). The property (Figure 3-2), which contains a total area of approximately 160 ha, is presently uninhabited, partially forested and lies within the Big Brook watershed. Millbank is in the jurisdiction of the Ferry Road - Russellville Local Service District.

The generating station will consist of four 100 MW (nominal) turbine units and all necessary support facilities. These facilities, as shown in Figure 3-3, will include:

- a paved access road (30 m corridor) into the site from Route 11;

- the four self-contained combustion turbine units, each occupying a surface area of approximately 925 m^2;

- two - 42,000 m^3 fuel oil storage tanks (60 m diameter x 15 m height) which will be enclosed within a dyked area;

- an earthen pond which will be used for water supply storage and fire protection reservoir, slightly in excess of 2000 m^3;

- a switchyard which will regulate the electrical power generated by the plant;

- a 1600 m^2 single story auxiliary building which will house a raw water treatment system, lavatory facilities, maintenance, staff and stores areas, and various station control rooms; and

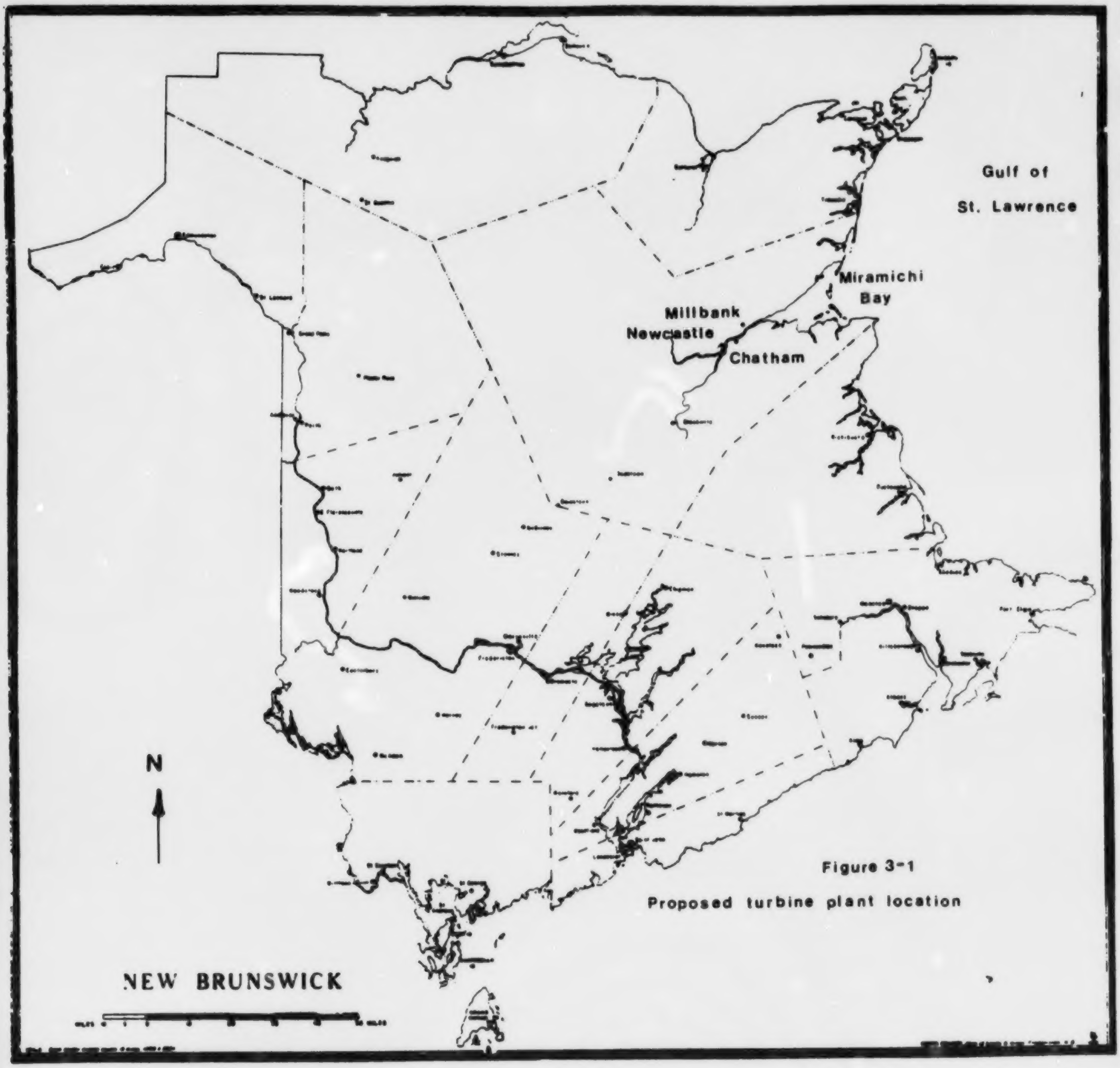
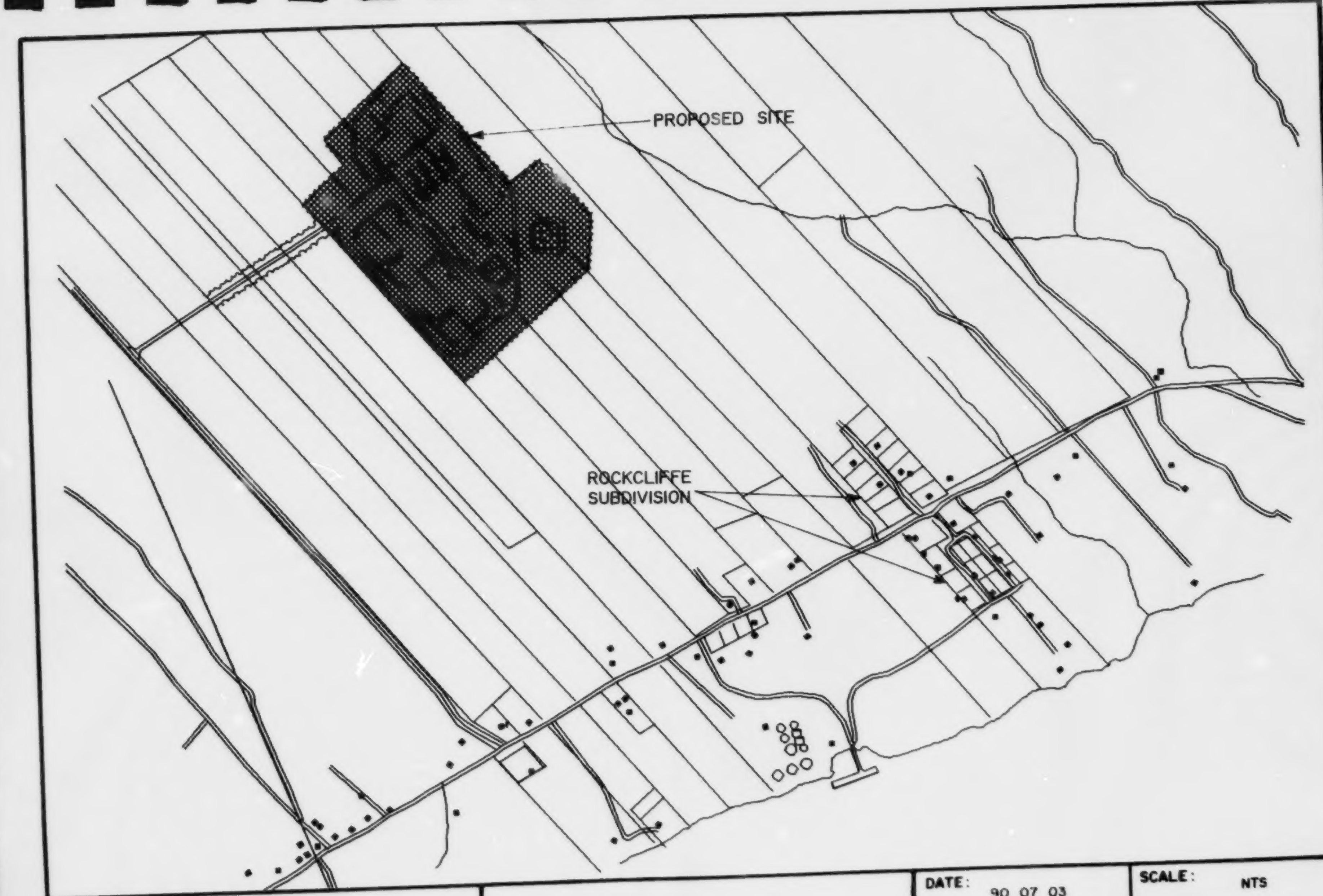

Gulf of
St. Lawrence
Miramichi
Bay
Millbank
Newcastle
Chatham
N
NEW BRUNSWICK

Figure 3-1

Proposed turbine plant location


PROPOSED SITE
ROCKCLIFFE SUBDIVISION

PROPOSED SITE
MILLBANK T.G.S.

DATE: 90 07 03

SCALE: NTS

FIGURE No.: 3-2

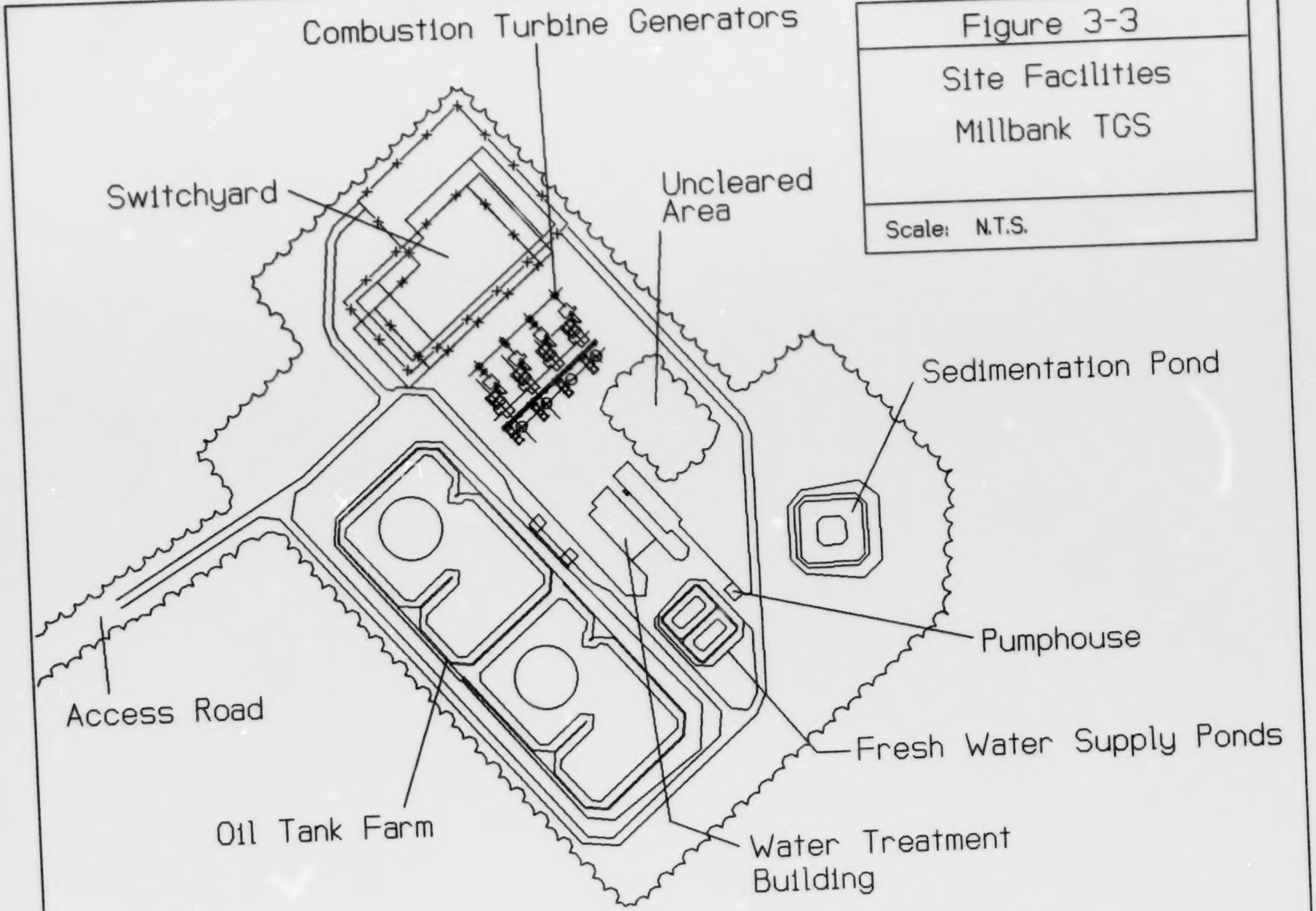

Combustion Turbine Generators
Switchyard
Uncleared Area
Sedimentation Pond
Access Road
Pumphouse
Fresh Water Supply Ponds
Oil Tank Farm
Water Treatment Building

Figure 3-3

Site Facilities

Millbank TGS

Scale: N.T.S.

- a transmission line corridor for interconnections to the NB Power grid system incorporating two 138 kV lines and one 230 kV line.

Approximately 22 ha of the 160 ha site will be cleared or otherwise used to provide space for the above facilities. This area will be enclosed within a security fence. The remainder will serve as an undisturbed buffer zone, and will be accessible to the general public.

3.2 Power Plant

The general arrangement for each of the four combustion turbine units is given in Figure 3-4. The major features of each unit will include:

- the turbine and combustor;

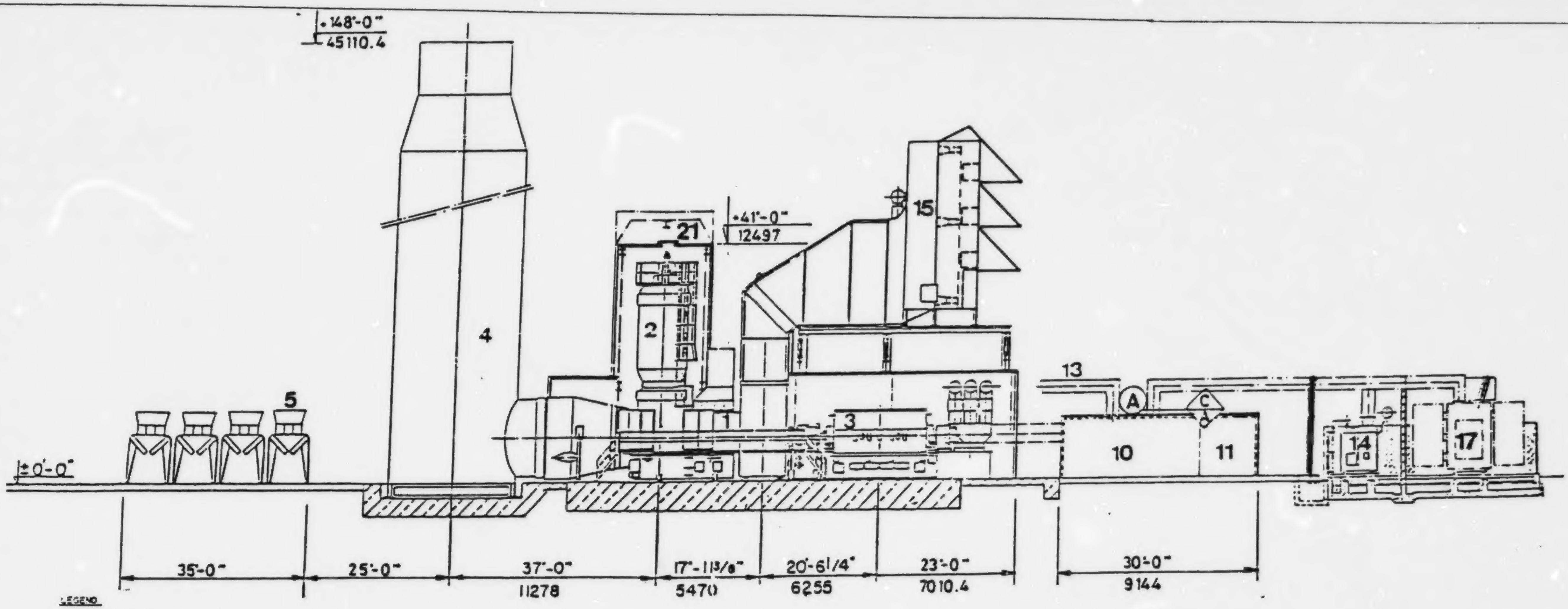
- the generator;

- the air intake and filter system, and

- exhaust stacks, 45 m (height) x 7.6 m (diameter).

The principle of operation of the combustion turbines is shown in Figure 3-5. Diesel fuel will be mixed with compressed air and burned in the combustor to generate a larger volume of exhaust gases. The flow of exhaust gases across the blades in the turbine generates rotational mechanical energy which will be used to drive both the air compressor and the electricity generator. During peak load, the four units will consume approximately 30 L/s of diesel fuel.

Emissions from the proposed facility are controlled in the first instance by fuel selection and by project design. The choice and characteristics of the fuel are discussed in Section 3.4. The project specifications have been designed in such a way as to meet or improve



•148'-0"
45110.4
4
21
•41'-0"
12497
15
2
5
13
A
C
1
3
10
11
14
17
±0'-0"
35'-0"
25'-0"
37'-0"
11278
17'-11 3/8"
5470
20'-6 1/4"
6255
23'-0"
7010.4
30'-0"
9144

LEGEND

1	GAS TURBINE BLOCK
2	COMBUSTOR
3	GENERATOR EXCITER BLOCK
4	EXHAUST STACK
5	AIR / WATER COOLERS
6	INTERCOOLERS / INTERCOOLING WATER PUMPS SKID
7	AUXIL. TRANSFORMER
8	MEDIUM VOLTAGE SWITCHGEAR
9	CONTROL AND POWER DISTRIBUTION MODULE AA
10	STARTING MODULE CC
11	BATTERY MODULE BB
12	GENERATOR BREAKER MODULE DD
13	GENERATOR BUS DUCT
14	UNIT AUXILIARY TRANSFORMER (BY CLIENT)
15	AIR INTAKE FILTER
16	LAYDOWN AREA GT
17	MAIN TRANSFORMER (BY CLIENT)
18	WATER INJECTION BLOCK
19	WATER INJECTION PUMP SKID
20	FUEL PUMP BLOCK
21	AUX. CRANE (BURNER MAINTENANCE)

Figure 3-4
Combustion Turbine Layout
Millbank TGS

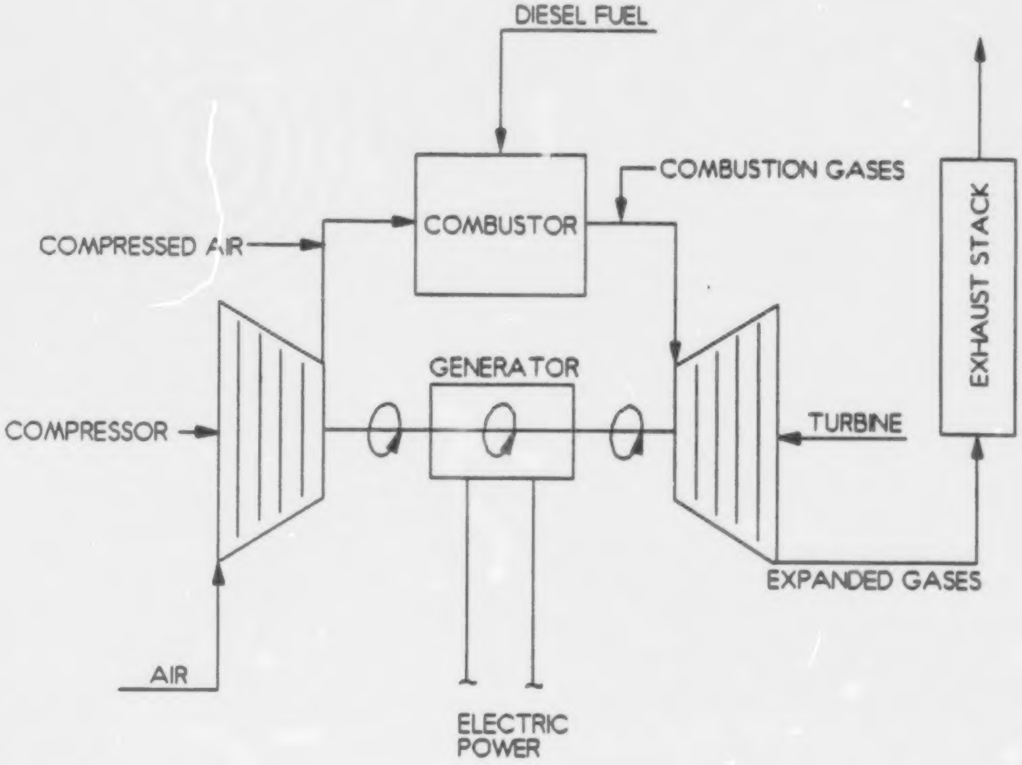

DIESEL FUEL
COMBUSTION GASES
COMBUSTOR
COMPRESSED AIR
EXHAUST STACK
GENERATOR
COMPRESSOR
TURBINE
EXPANDED GASES
AIR
ELECTRIC POWER

FIGURE 3-5
COMBUSTION TURBINE

upon the suggested limits for SO_2 and particulates, as stated in Environment Canada's "Thermal Power Generation Emissions - National Guidelines for New Stationery Sources (1981)". Uncontrolled emissions of SO_2 and particulates will achieve these guidelines.

In the case of NO_x, a water injection system to reduce formation of nitrogen oxides has been included in order to control these emissions and achieve the guideline limit. This system is the only demonstrated control measure for this type of peaking facility. There are no dry combustor technologies available for combustion turbines fuelled with diesel oil; SCR technology (Selective Catalytic Reduction) cannot be applied to peaking cycle service due to the combustion turbine exhaust temperature being well above the upper temperature limit of the SCR catalyst.

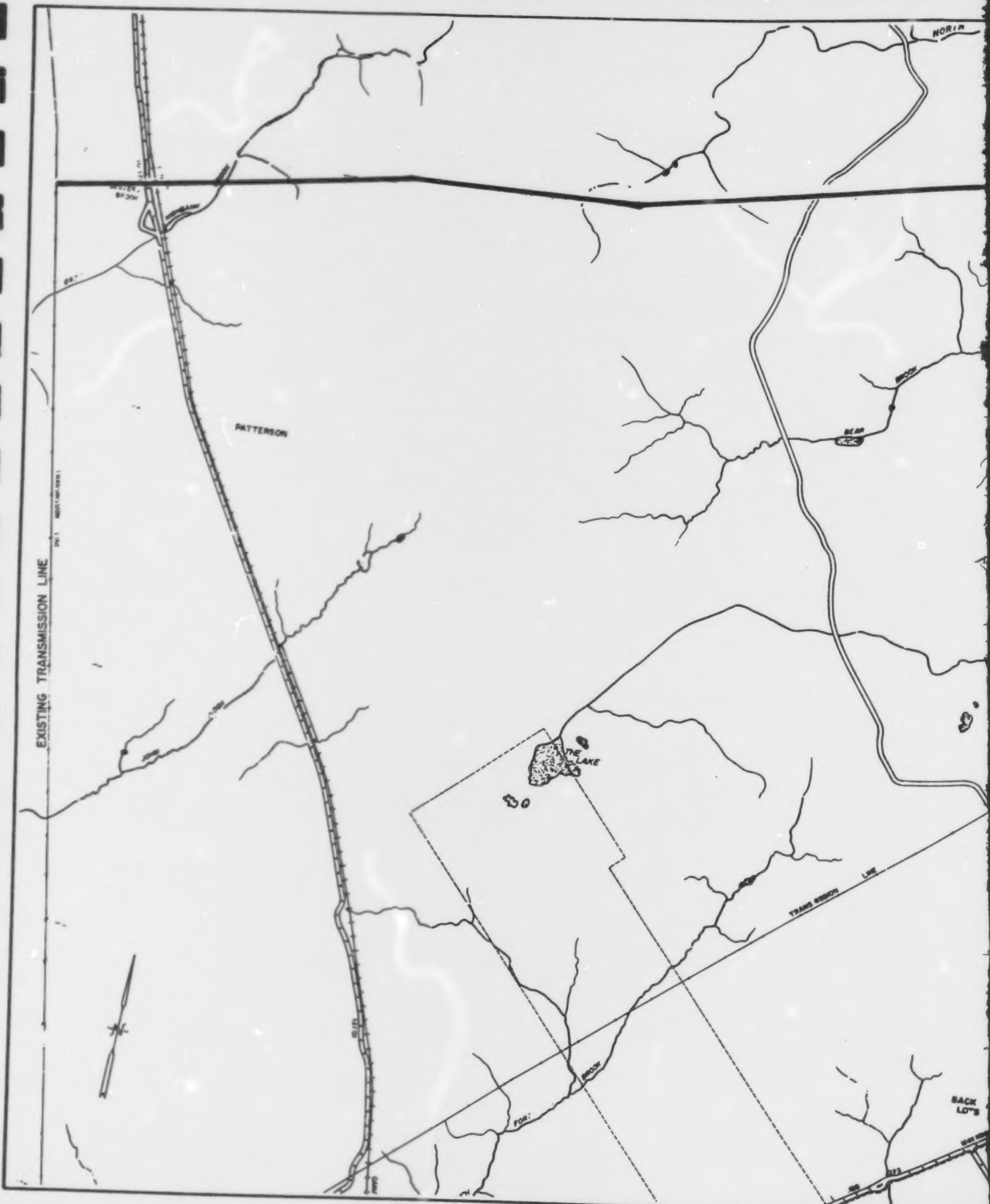
3.3 Transmission Line Interconnections

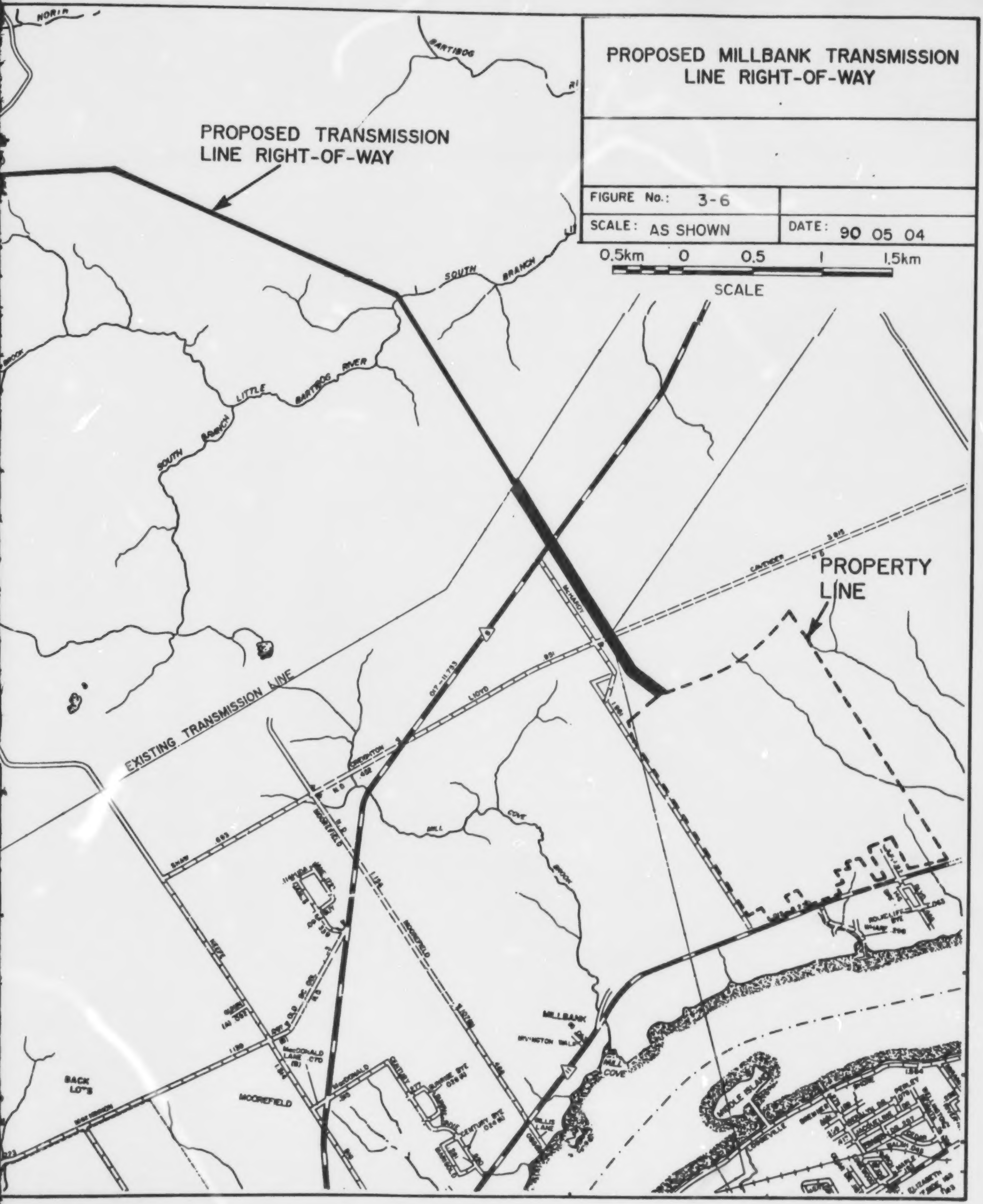
The proposed corridors for transmission line interconnections to the existing grid are shown in Figure 3-6. Interconnections will be made to existing 138 kV and 230 kV transmission lines. A 90 m right-of-way will be used from the plant site to NB Power's line 1106 (138 kV) located northwest of the site. This corridor will have a length of approximately 3 km. The 90 m wide corridor will contain two-138 kV lines and one-230 kV line with wood pole structures (Figure 3-7). The 230 kV interconnection will then proceed along a 40 m right-of-way to meet NB Power's line 2131, west of the power plant site.

3.4 Fuel and Fuel Storage

The only fuel available in New Brunswick for combustion turbine technology is No. 2 diesel fuel.

At present, the sulphur content of diesel fuel is limited to an upper concentration of 0.5 percent by weight, under federal and provincial regulation.


NORTH
EXISTING TRANSMISSION LINE
PATTERSON
BEAR
BROOK
THE LAKE
TRANSMISSION LINE
FOR
BROOK
BACK LOTS
173


PROPOSED TRANSMISSION LINE RIGHT-OF-WAY
PROPERTY LINE
EXISTING TRANSMISSION LINE
0.5km 0 0.5 1 1.5km
SCALE
BARTIBOG
SOUTH BRANCH
LITTLE BARTIBOG RIVER
SOUTH BRANCH
BROOK
NORIA
MILL COVE BROOK
MILLBANK
MILL COVE
MOOREFIELD
BACK LOTS
MIDDLE ISLAND
LLOYD
CREIGHTON
SHAW
MOOREFIELD
MILLIS LANE

PROPOSED MILLBANK TRANSMISSION LINE RIGHT-OF-WAY

FIGURE No.: 3-6

SCALE: AS SHOWN

DATE: 90 05 04

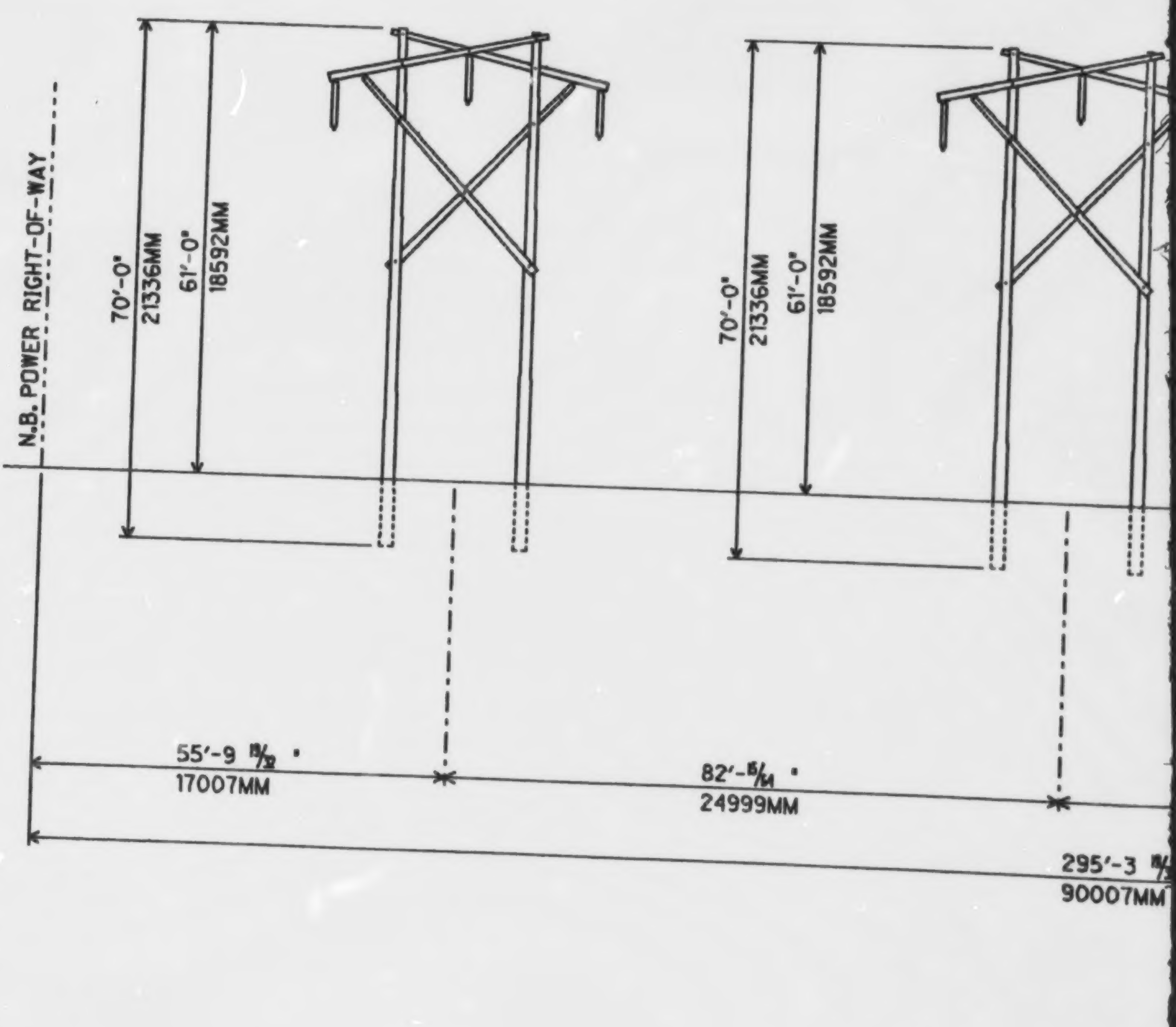
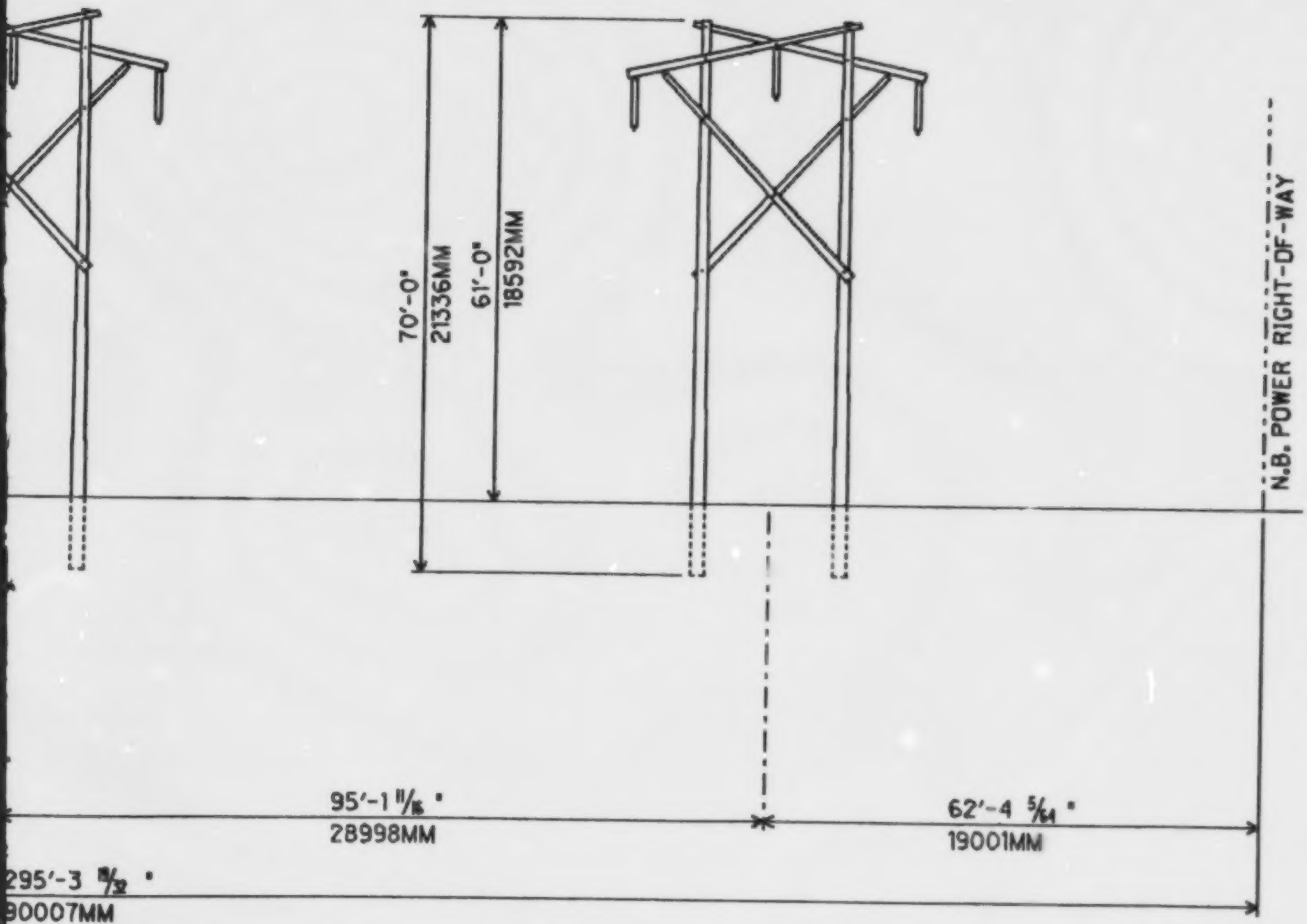

N.B. POWER RIGHT-OF-WAY
70'-0"
21336MM
61'-0"
18592MM
70'-0"
21336MM
61'-0"
18592MM
55'-9 13/32 •
17007MM
82'-15/64 •
24999MM
295'-3
90007MM

FIG. 3-7
MILLBANK
TRANSMISSION LINE
CONFIGURATION


70'-0"
21336MM
61'-0"
18592MM
N.B. POWER RIGHT-OF-WAY
95'-1 11/16"
28998MM
62'-4 5/64"
19001MM
295'-3 11/32"
90007MM

In late June 1990, Environment Canada released its plan to publish a Notice of Intent for New Diesel Fuel Quality Standards. The regulations under consideration would limit the sulphur content of diesel fuel to 0.05 percent by weight. The formal Notice of Intent will invite all interested parties to comment within 30 days of publication. If approved, sulphur-dioxide emissions from the combustion of the new quality diesel fuel could be 90 percent lower than those from existing diesel fuel. These proposed changes in diesel fuel quality could also effect reduction of other air contaminants.

Fuel delivered to the site by tanker trucks will be stored in two steel tanks, each with a capacity of approximately 42,000 m^3. The tanks, which will be designed to meet American Petroleum Institute standards, will each have a diameter of 60 m and height of 15 m. The tanks will be contained within individually dyked and lined areas to ensure the containment of any spills. The dyked areas will have a capacity for 110 percent of the tank volume to ensure complete containment under the worse case condition of tank failure. All facilities will be designed and installed in accordance with the requirements of the New Brunswick Regulation 87-97, Petroleum Product Storage and Handling.

Fuel not used at the end of the expected operating season will be stored over the summer with topping up of tanks taking place prior to the onset of the peak demand period in winter.

The structural integrity of the fuel oil storage tanks will be tested by hydrostatic testing. Approximately 40 million litres (8.7 millon gallons) will be pumped from the freshwater wells on-site to fill the tank. This water will then flow back into the wells to drain the tank. Prior to filling of the tank, the steel will have been shop blasted and the tank mechanically cleaned after erection. No chemicals or pollutants of any kind will be added to the test water. The discharge will be strained in order to ensure that no rust particles, sand, or other debris which may have escaped the initial cleaning process are introduced to the aquifer.

All pipe and valves for delivery of fuel from the storage area to the turbine generator will be contained within diked areas or in concrete tunnels. All drainage from the storage and fuels handling areas will pass through an oil-water separator prior to discharge into the waste water drain line.

3.5 Water Supply

During the electricity generating cycles, the power plant will require approximately 66 L/s of water. Most of this water (49 L/s) will be demineralized by a water treatment system and injected into the power plant combustion system to minimize the formation of nitrogen oxides. This water will exit the exhaust stack as vapour. The remainder, approximately 17 L/s, will be discharged from the water treatment system as wastewater (Section 3.9.2).

Water supply for the operation will be provided by a series of groundwater wells. Water will be pumped from the wells into a lined storage reservoir with a capacity of approximately 2000 m^3. The reservoir will provide storage for the design fire situation, plus a volume of water to balance flows between the well supply and water treatment plant. There will be a one metre freeboard to allow for winter ice conditions.

The water from the reservoir will have to be demineralized to an almost distilled water standard before it can be injected into the gas turbines. The demineralization system will include the following components in series (Figure 3-8):

- a dual-media (manganese greensand and anthracite) filter for removal of suspended matter and iron;
- a reverse osmosis unit for removal of dissolved solids;
- a decarbonation unit for reduction of carbon dioxide, and

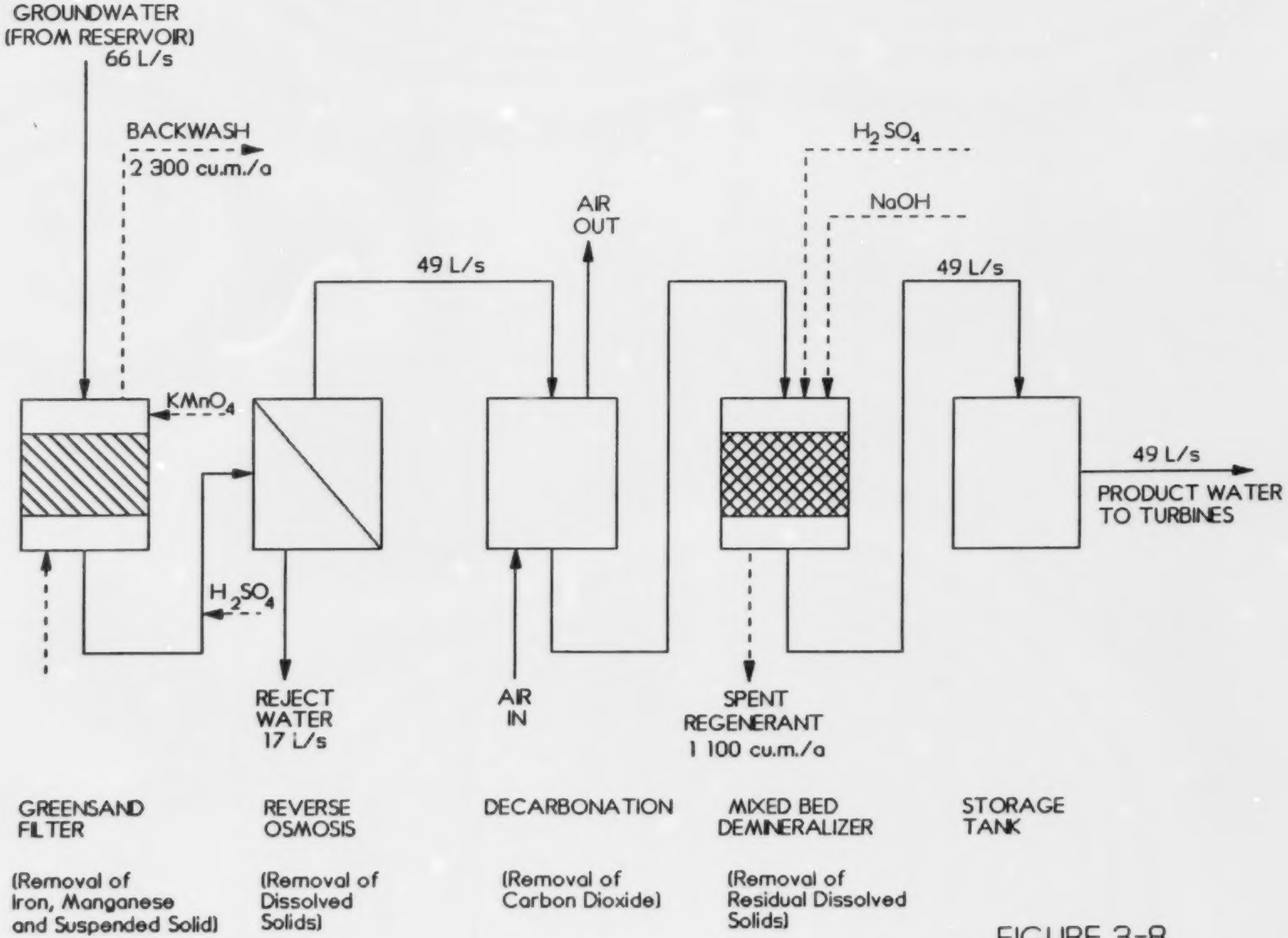

GROUNDWATER
(FROM RESERVOIR)
66 L/s
BACKWASH
2 300 cu.m./a
KMnO$_4$
H$_2$SO$_4$
49 L/s
AIR
OUT
H$_2$SO$_4$
NaOH
49 L/s
49 L/s
PRODUCT WATER
TO TURBINES
REJECT
WATER
17 L/s
AIR
IN
SPENT
REGENERANT
1 100 cu.m./a
GREENSAND
FILTER
(Removal of
Iron, Manganese
and Suspended Solid)
REVERSE
OSMOSIS
(Removal of
Dissolved
Solids)
DECARBONATION
(Removal of
Carbon Dioxide)
MIXED BED
DEMINERALIZER
(Removal of
Residual Dissolved
Solids)
STORAGE
TANK

FIGURE 3-8
SCHEMATIC FLOW DIAGRAM
WATER DEMINERALIZATION

- a mixed bed demineralization unit for final "polishing" of the water to remove residual dissolved solids.

The reverse osmosis unit (Figure 3-8) will be similar to a filter. The water will be pumped through a semi-permeable membrane resulting in the removal of the majority of dissolved solids. Thus, the water which passes through the membrane (product water) will be "low" in total dissolved solids. The so-called "reject" water, which does not pass through the membrane, will contain the dissolved solids which have been removed from the product water. Some of this will be used as a source of backwash water for the dual media filters to reduce water consumption.

Residual dissolved solids contained in the product water will be removed by passage through a mixed bed demineralization system. This sytem will contain ion exchange media which will adsorb the dissolved solids. Periodically the ion exchange media will have to be "regenerated" by the addition of acid and base to the media. This process will cause the removal of the adsorbed solids resulting in a "spent regenerant" (Figure 3-8) which will be relatively high in total dissolved solids content.

3.6 Chemicals

In addition to various lubricants, a number of other chemical products will be used at the plant. These will include:

- caustic soda, approximately 2500 kg/year of 50 wt percent solution for the regeneration of the demineralization system;

- sulphuric acid, approximately 12,000 kg/year of 93 percent concentration, for the lowering of pH of the raw water at the inlet to the reverse osmosis system (to protect the membranes and to prevent scale formation) and for the regeneration of the demineralization system, and

- approximately 368 kg/year of potassium permanganate for oxidation of iron and magnesium in the greensand filter.

All chemicals will be stored in limited quantities at the site and in accordance with manufacturer's guidelines and NB Power standards. The design information for these facilities, which has not yet been developed, will be provided with the application for an Approval to Construct.

3.7 Liquid Wastes

Liquid wastes generated at the plant site will include:

- sewage;
- water treatment system effluent, and
- miscellaneous plant service water.

3.7.1 Sewage

During the construction phase, NB Power will be responsible for providing sanitary wastewater holding facilities. These will be pumped-out on a routine basis and the sewage transferred to a municipal treatment plant for disposal.

The power plant will have no resident staff. During fuel delivery, two persons will be on site. Hence, the plant will only require one washroom facility which will be connected to a septic tank/tile field disposal system. This system will be designed and installed in accordance with New Brunswick Department of Health requirements. This type of sewage treatment system will be consistent with those at existing residences in the Millbank area.

3.7.2 Water Treatment System

Operation of the water treatment system will generate several wastewaters as indicated in Figure 3-9. These will include:

- filter backwash;
- reject water from the reverse osmosis unit, and
- spent regenerant from the demineralization ion exchange system.

The filter backwash will contain suspended solids, including the added permanganate (Section 3.6) which will precipitate as insoluble manganese dioxide. The reject water from the reverse osmosis unit will contain dissolved salts removed from the groundwater and residual sulphate from the addition of sulphuric acid to protect the reverse osmosis membranes. The spent regenerant from the ion exchange system will contain the salts removed from the groundwater and residual sodium sulphate, the byproduct from the addition of caustic soda and sulphuric acid to regenerate the ion exchangers.

The filter backwash, reject water and spent regenerant will be discharged into a lined sedimentation pond for the removal of solids. As indicated in Figure 3-9, the reject water and spent regenerant will be pH adjusted prior to discharge into the sedimentation pond to ensure that overflow from the pond is in the acceptable pH range (6.5 - 9.5). The pH of the overflow from the sedimentation pond will be continuously monitored to ensure and confirm the acceptable pH range. The manual pH adjustment and monitoring systems will be fully defined in the application to the Province for an Approval to Construct. The solids will consist of silt, iron and manganese removed from the groundwater, and sparingly soluble salts such as calcium carbonate and gypsum which may precipitate from the neutralized reject water and spent regenerant. The sedimentation pond, with a surface area of approximately 900 m^2 and a total volume of 1800 m^3, will be designed to

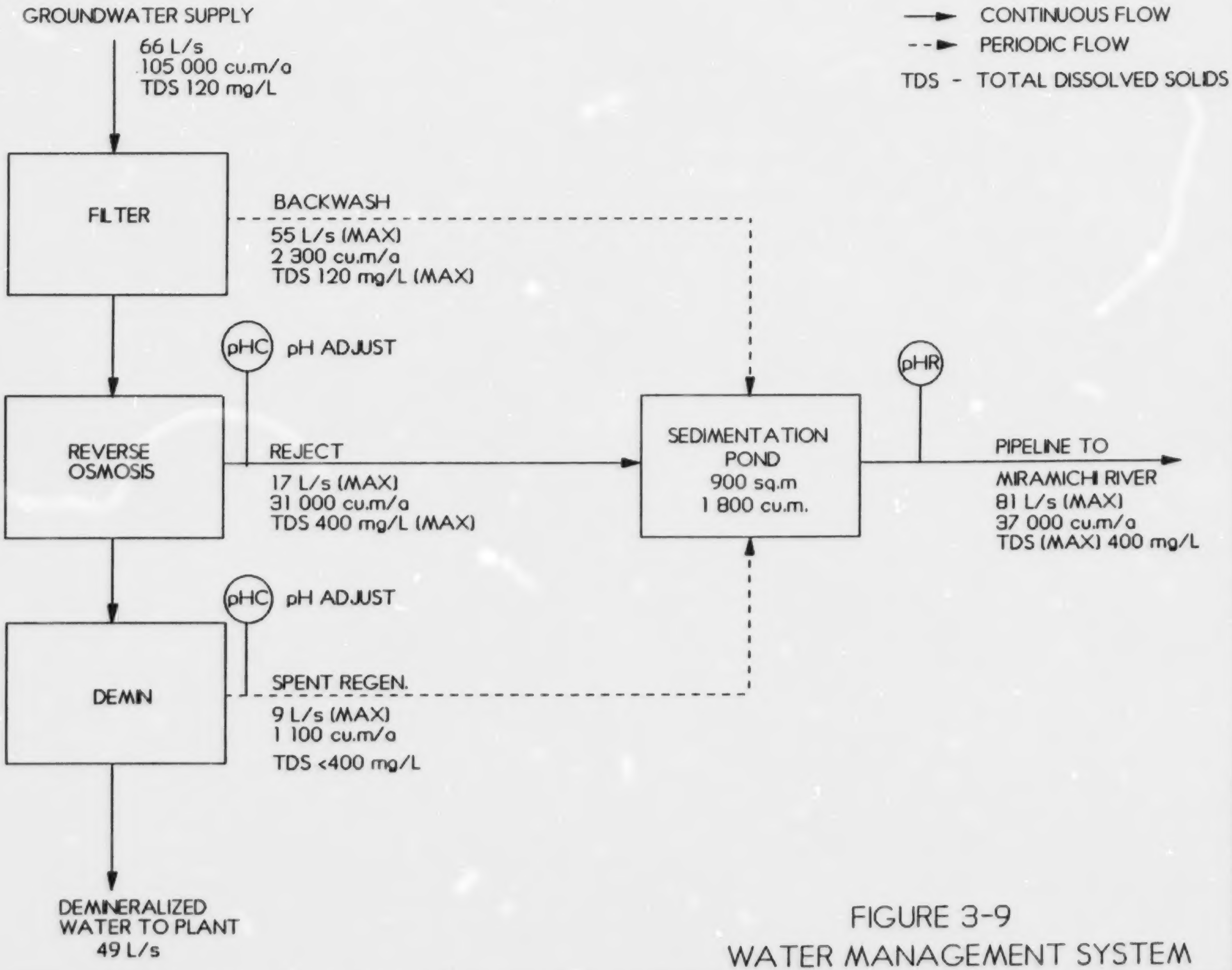

GROUNDWATER SUPPLY
66 L/s
105 000 cu.m/a
TDS 120 mg/L
CONTINUOUS FLOW
PERIODIC FLOW
TDS - TOTAL DISSOLVED SOLIDS
FILTER
BACKWASH
55 L/s (MAX)
2 300 cu.m/a
TDS 120 mg/L (MAX)
pHC
pH ADJUST
REVERSE OSMOSIS
REJECT
17 L/s (MAX)
31 000 cu.m/a
TDS 400 mg/L (MAX)
SEDIMENTATION POND
900 sq.m
1 800 cu.m.
pHR
PIPELINE TO
MIRAMICHI RIVER
81 L/s (MAX)
37 000 cu.m/a
TDS (MAX) 400 mg/L
pHC
pH ADJUST
DEMIN
SPENT REGEN.
9 L/s (MAX)
1 100 cu.m/a
TDS <400 mg/L
DEMINERALIZED WATER TO PLANT
49 L/s

FIGURE 3-9
WATER MANAGEMENT SYSTEM

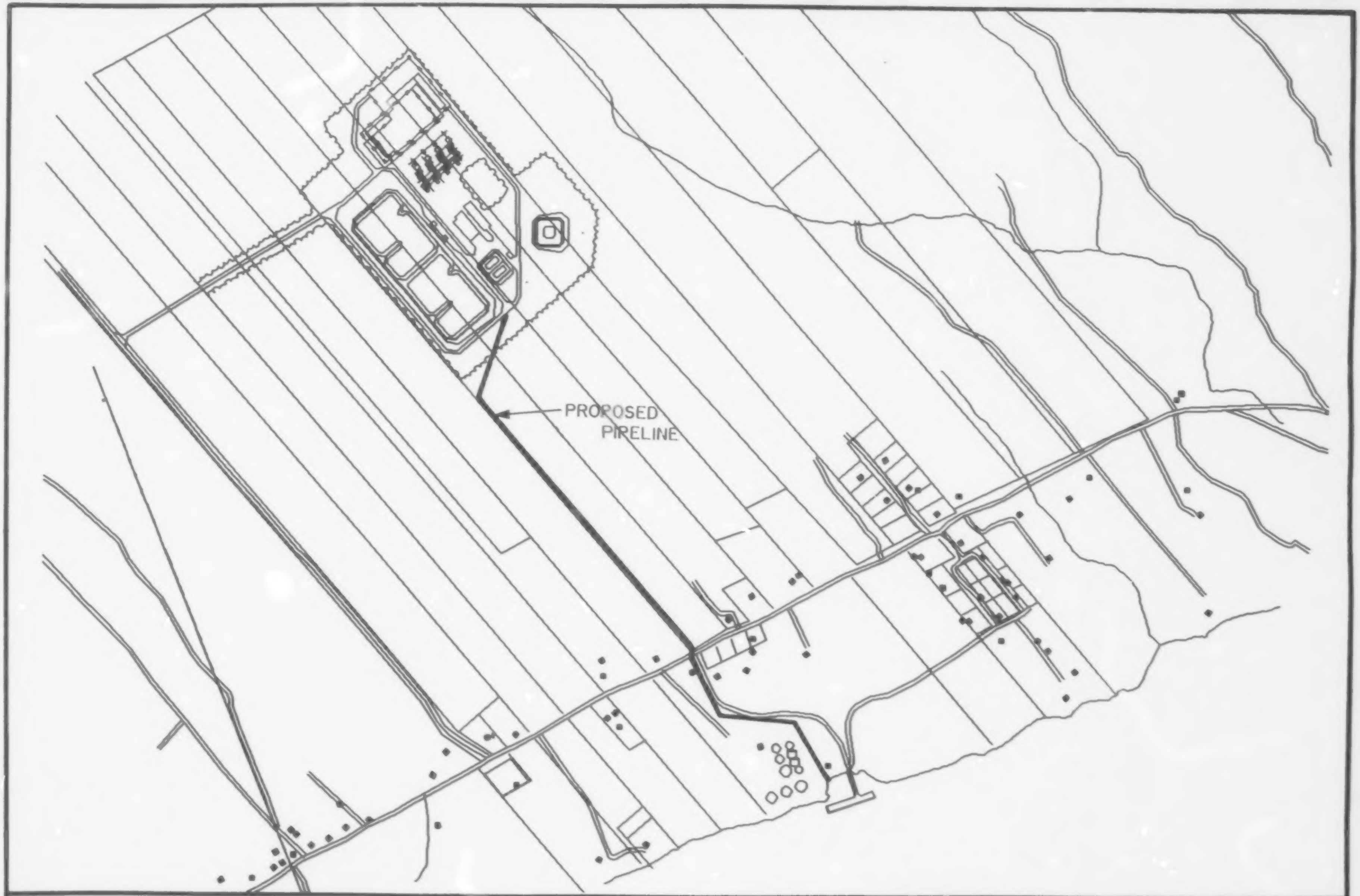
provide an applied clarification overflow rate of 0.3 m/h at the peak influent flowrate (81 L/s). This conservative design criterion will ensure the maximum removal of settleable particulates. Coagulants will be used if necessary to ensure the removal of colloidal solids. The settled solids will be periodically removed from the sedimentation pond and transported for disposal at one of NB Power's ash disposal sites (i.e., Chatham, Dalhousie or Belledune). The generation of such solids will be less than 1 t/a based on the quality of groundwater and the proposed demineralization system.

The quality of the overflow from the sedimentation pond will be consistent with the requirements of the "Codes of Practice" (Environment Canada, 1985) and will meet the requirements specified in the Chatham Power Plant approval from the Province for sedimentation lagoon overflow. The expected quantity and composition of these effluents are given in Table 3-1. The slightly brackish water (TDS ~400mg/L) will be discharged into the saline waters of the Miramichi River by means of a pipeline (approximately 450 mm diameter) from the plant site to the Miramichi River, near the existing Millbank wharf (Figure 3-10).

The location of the pipeline is shown in Figure 3-10. It will drain entirely by gravity flow, and will consist of PVC pipe of 374 mm - 450 mm diameter with regular manholes. The diameter of this pipeline will be based on the peak flowrates for overflow from the sedimentation pond (81 L/s - Figure 3-9) and overflow surface runoff collected in the storage tank diked area and passed through the oil water separator (40 L/s) based on the 1 in 25 year return period storm. The outfall will discharge on bottom, below L.W.O.S.T., and will be protected with rip-rap.

3.7.3 Miscellaneous Plant Service Water

The small quantities of water used for general plant services will be drained into the sedimentation pond for the removal of solids (Section 3.7.2). Floor drainage, which may


PROPOSED
PIPELINE

MILLBANK TGS
WASTEWATER PIPELINE

DATE: 90 07 03

SCALE: NTS

FIGURE No.: 3-10

TABLE 3-1

Water Treatment Effluents

Parameter[a]	Codes of[b] Practice Limit	NBDOE[c] Approved for Chatham G.S.	Combustion Turbine Sedimentation Pond Overflow
Flowrate - max (L/s)	-	-	81 (max)
Flowrate - avg (L/s)	-	-	19 (avg)
Suspended solids	$\leq$25	$\leq$20 (40)[d]	$\leq$20
Total Dissolved Solids (mg/L)	-	-	$\leq$400
Hardness (mg/L as $CaCO_3$)	-	-	$\leq$120
Sulphate (mg/L)	-	-	$\leq$300
Oils and grease	$\leq$15	$\leq$10.0	$\leq$10
pH	6.5-9.5	6.0-9.5	6.5-9.5
Iron	$\leq$1.0	$\leq$1.0	<1.0
Arsenic	-	$\leq$0.5	$\leq$0.5
Barium	-	$\leq$1.0	$\leq$1.0
Cadmium	-	$\leq$0.005	$\leq$0.005
Lead	-	$\leq$0.2	$\leq$0.2
Mercury	-	$\leq$0.001	$\leq$0.001
Copper	$\leq$0.5	$\leq$0.1	$\leq$0.1
Chromium (total)	$\leq$0.5	$\leq$0.2	$\leq$0.2
Chromium (hexa)	$\leq$0.05	-	$\leq$0.05
Nickel	$\leq$0.5	$\leq$0.5	$\leq$0.5
Zinc	$\leq$0.5	0.2	$\leq$0.2

[a] - all concentrations are mg/L

[b] - Source: Environment Canada, 1985

[c] - for sedimentation lagoon overflow

[d] - 40 - maximum in any individual sample

contain lubricants, will drain into an oil-water separator prior to discharge into the sedimentation pond.

3.8 Construction Phase

The construction phase of the Millbank TGS (Turbine Generating Station) is estimated to be 17 months over the period June 1990 to November 1991 (including tendering). Construction of the foundations for the facilities is anticipated to commence September, 1990.

3.8.1 Construction Labour Force

The construction phase of the project will create a total of 251 person years of employment over the 17 month construction period. Table 3-2 shows a preliminary breakdown of the person months required by time period and activity. The period of highest employment will be January to October 1991 when an average of 169 persons will be employed. The majority of the employment will involve construction trades.

Table 3-3 shows a preliminary breakdown of the construction trades required for the project. Approximately 90 percent of these jobs will be unionized.

A temporary camp to house non-resident construction workers will not be developed.

3.8.2 Investment

The total capital expenditure (including labour) for the Millbank TGS is anticipated to be approximately $252,000,000. Table 3-4 shows a breakdown of expenditures and indicates that just over 27 percent of the total expenditure will be in New Brunswick. The major purchases outside the Province will be for materials. Ninety-five percent of the labour force will be from New Brunswick.

TABLE 3-2

Millbank TGS Construction Work Force (Preliminary)

	Engineering	Management	Commissioning	Construction	Transmission & Terminal	Total /Month
March/90	11	2	–	–	–	13
April	15	2	–	–	–	17
May	15	3	–	–	–	18
June	20	3	–	–	–	23
July	25	3	–	–	–	28
Aug.	25	5	–	–	–	30
Sept.	25	7	–	20	–	52
Oct.	25	7	–	20	–	52
Nov.	20	7	–	25	–	52
Dec.	20	7	–	50	–	77
Jan./91	15	8	–	70	–	93
Feb.	12	8	2	100	–	122
March	10	8	5	100	25	148
April	7	8	10	100	25	150
May	7	8	12	160	25	239
June	7	8	14	160	25	214
July	7	8	20	170	25	230
Aug.	7	8	25	170	25	235
Sept.	7	8	25	100	25	165
Oct.	7	8	25	50	–	90
Persons Months	287	126	138	1295	175	2021

Total Person
Years = 218 + 33 = 251 Person Years

Source: NB Power Engineering Department, April 1990

TABLE 3-3

Millbank TGS, Breakdown of Construction Trades (Preliminary)

Electricians		20%
Pipefitters		20%
Millwrights		10%
Iron Workers		15%
Boilermakers		15%
Carpenters		5%
Labourers		5%
Operators		5%
Painters	}	5%
Insulators	}	
Sheetmetal Workers	}	

Source: NB Power Engineering Department, April, 1990.

TABLE 3-4

Millbank TGS Investment Breakdown

	$	% NB	$ NB
(Direct)			
Rental - equipment	8,937,700	100%	8,937,700
Labour	21,897,500	95%	20,802,625
Material	144,344,500	10%	14,434,450
Land and Right-of-ways	2,234,400	100%	2,234,400
Services to Business	9,805,700	90%	8,825,100
(Indirect)			
Interest	18,344,700		-
Escalation	5,217,400		1,539,100
Contingency	41,218,100		12,159,300
TOTAL	$252,000,000	TOTAL NB	$ 68,932,675

Source: NB Power Estimating Department, May, 1990.

3.9 Operational Phase

The operating life of the Millbank TGS is anticipated to be 35 years. A start up in November of 1991 is planned. The facility is designed to provide peaking power and is anticipated to operate primarily during the winter months for a total of 500 hours per year. During this period, typical peaking requirements would be from 6:00 AM to 10:00 AM and from 4:00 PM to 10:00 PM. Worst case operating requirements for the Millbank combustion turbines are 6 days at 16 hours per day, full load and/or 48 hours continuous operation at full load.

The plant would operate additional hours to provide capacity in New Brunswick in the event of an emergency, such as the unexpected outage of the baseload Point Lepreau Generating Station.

3.9.1 Operating Costs

Annual operating costs are estimated to be approximately $5,000,000, excluding depreciation.

3.9.2 Operating Labour Force

Eleven new, full-time permanent jobs will be created for the operation and maintenance of the Millbank TGS. Electricians, electrical mechanics and millwrights will be required for these positions. The Millbank TGS will be unmanned and operated from the Chatham Generating Station. The average salary per person year is estimated to be $43,000 (1989) plus benefits.

3.9.3 Fuel Consumption and Delivery

The Millbank TGS will require approximately 375,000 barrels of oil annually. Fuel will be trucked to the facility from refineries as far away as Saint John, NB or Dartmouth, NS, at an annual cost estimated to be in the range of $1m (1990). If possible, fuel will be purchased between April 1 and November 1 to ensure an adequate supply at least cost. If fuel is delivered during this period, ten trucks per day will be required. If fuel is delivered over 12 months, eight trucks per day will be required. Fuel deliveries at plant site by truck will normally be during normal working hours, only on weekdays.

CHAPTER FOUR

BIOPHYSICAL SETTING

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4.0 BIOPHYSICAL SETTING

4.1 Introduction

This section introduces the baseline environment of the plant site and surrounding area including the nearby Miramichi River. The existing terrestrial, aquatic and atmospheric conditions in the area are described. Socioeconomic conditions, including such features as landuse, are discussed in Section 5.0.

4.2 Terrestrial Environment

4.2.1 Power Plant Site

4.2.1.1 Geology and Physiography

The bedrock underlying the study area consists of sedimentary rocks which are of Carboniferous Age on the geological time scale (more precisely the middle to late Pennsylvanian Age Pictou Group). These rocks typically have a light brown to grey, or occasionally reddish, colour and occur in flat lying to gently dipping beds. The Carboniferous Basin covers eastern New Brunswick and has a triangular shape which extends from Bathurst to Fredericton to Moncton and into northern Nova Scotia and Prince Edward Island. The rocks originated as sediments deposited by major river systems in a floodplain environment. They consist of interbedded layers of sandstones and shales with occasional channels of coarser material known as conglomerate. Underlying these strata are older formations which, for the purposes of this study, will be referred to as 'basement' rocks.

The geological units in the study area have historically been of little economic interest. Coal is known to occur at several locations in the Carboniferous Basin and most of the mineral exploration work which has been conducted was for this commodity. The relative paucity of geological data for the study area relative to other regions of the Province is a reflection of this limited economic interest. Geological mapping is on a broad scale with the most recent having been completed by the New Brunswick Department of Natural Resources and Energy (Ball et al., 1982). The available mapping information was reviewed in the course of the study.

The program conducted by the NBDNRE included numerous drillholes but none were located in close proximity to the study area. However, other projects provide some information of interest. A deep mineral exploration drillhole at Bartibog, to the north of the study area, passed through 683 m of sedimentary rocks before basement was intersected. A drillhole at Beaver Brook, about 15 km to the west, intersected basement at 986 m. These variations in the depth to basement are believed to be the result of regional scale geological faulting which produced a 'basement topography' prior to the deposition of the sediments. Although the faults are thought to have originally developed prior to the deposition of the overlying sediments, there is a good probability that movement also occurred at a later time.

A major fault system (the Catamaran fault) is reported to follow the Miramichi River in the vicinity of the study area but it has not been active for 300 million years (Anderson, 1972). Secondary faulting and fracturing associated with this system are of interest to the present study since they typically represent zones of high secondary permeability which could yield the quantities of water required for the development. Examination of topographic data and interpretation of aerial photographs indicated the presence of subtle linear features which could represent zones of higher permeability. These features were evaluated in more detail in subsequent phases of the study.

The surficial (i.e. above the bedrock) geology of the study area is relatively straightforward. As the glaciers retreated approximately 12,000 years ago they left a thin layer of till deposits containing a mixture of sand, clay and boulders. The weight of the glaciers had depressed the earth's surface relative to sea level and the coastline in the vicinity of the study area at that time was 1 to 2 kilometres inland from its present position. This permitted the sea to rework the till deposits and a thin layer of marine sediments was deposited. The sea subsequently retreated allowing vegetation to develop, resulting in the existing landscape conditions. Detailed data on the surficial geology in the region is not available but recent publications of the Geological Survey of Canada (Rampton et al., 1984) provide a regional setting for the study area.

Test drilling conducted in the course of this study provided a measure of confirmation of the regional geological data. The four test holes intersected 3 to 6 m of overburden which was underlain by several metres of soft weathered bedrock. The test holes extended to depths of 90 m and intersected mainly sandstone and shales.

The study area is within the New Brunswick Lowlands physiographic zone. The land surface slopes gently and ranges in elevation from approximately sea level at the Miramichi River and 25 m near Route 11 to an elevation in excess of 80 m at the north end of the study area. The surface tends to be gently undulating but stream valleys are incised.

4.2.1.2 Surficial and Sub Surface Geology

Generally the terrain surrounding the site of the proposed generating station can be described as a broad, flat plateau that is deeply dissected by rivers and streams. At the site, the terrain slopes gently southward toward Miramichi Bay. A tributary of Big Brook has cut a small shallow valley through the centre of the site.

As in most of eastern New Brunswick, the geology consists of flat-bedded or gently dipping sandstones, shales, and conglomerates of Carboniferous age. The surface tills are primarily of a clay loam or sandy loam texture.

4.2.1.3 Local Surface Water Resources

The proposed generating station is located within the drainage area of Big Brook which is one of many small systems draining the north shore of Miramichi Bay. Big Brook has a total drainage area of 430 ha that includes one tributary. At the Route 11 culvert, Big Brook appears to have a channel width of 1-2 m.

Discussions with NBDNRE in Newcastle suggest that there is little or no angling in Big Brook because of its small size. However, this stream does support brook trout as do most small streams in this area. Rainbow smelt have been recorded spawning in this brook in the past (McKenzie, 1964) and probably continue to do so. Smelt are known to spawn in most other small streams along the Miramichi estuary.

A tributary of Big Brook dissects the site of the proposed power generating facility (Figure 3-2 and Figure 3-6). Visual observation in May, 1990 noted the presence of newly hatched brook trout fry in the tributary approximately midway along its length.

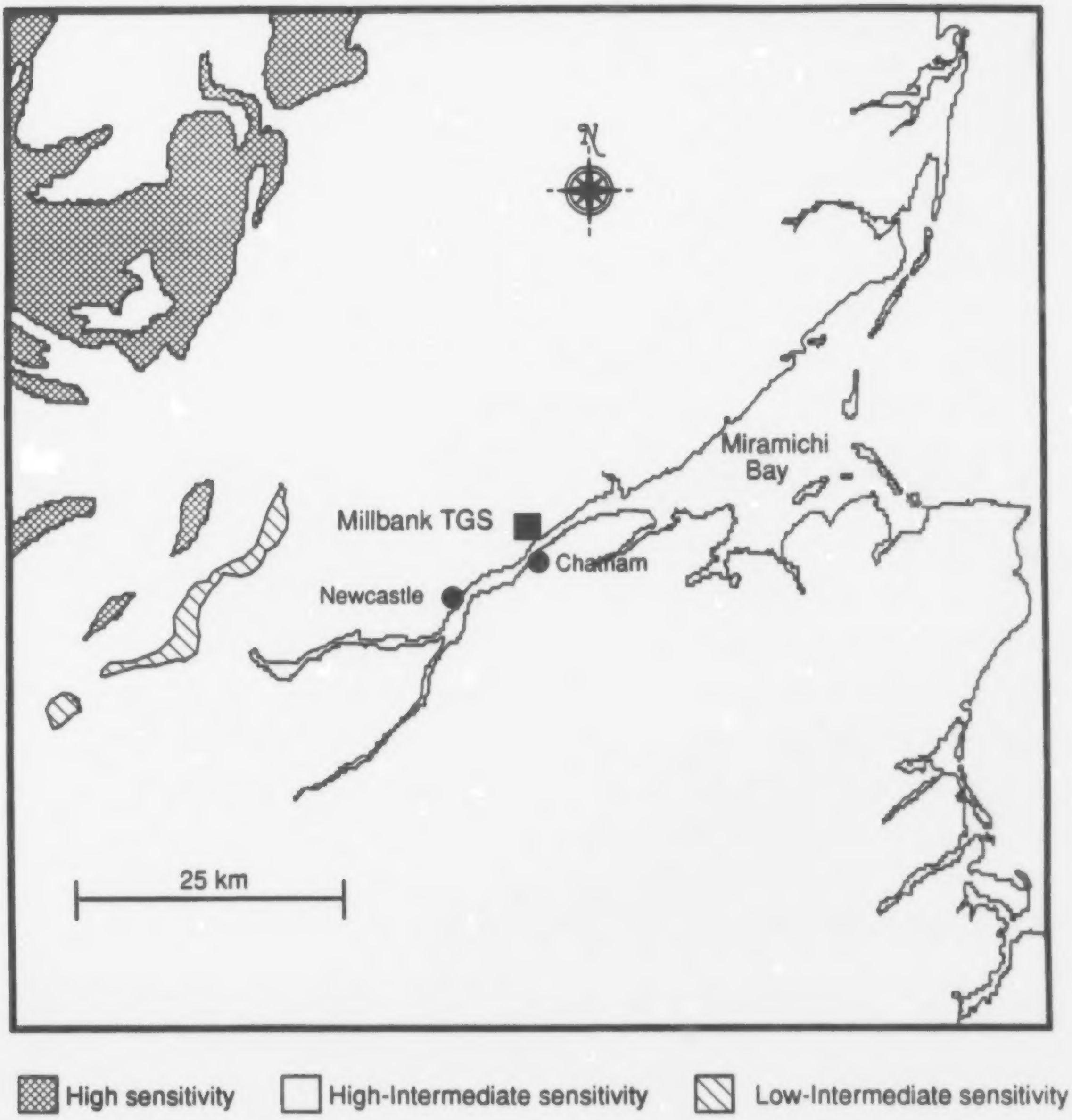
4.2.1.4 Sensitivity of Bedrock and Agricultural Soils to Acid Precipitation

A national acid rain sensitivity assessment was carried out by the Geological Survey of Canada (Shilts, 1981). It provided a national evaluation of surface water resources at risk, based on the potential of soils and bedrock to reduce acidity. Within the defined airshed, there are some highly sensitive areas to the northwest of the site as shown in Figure 4-1.

Highly sensitive soils have low to insignificant buffering capacity mainly due to cation exchange with clay and silt-sized detritus. These identified areas consist mainly of felsic volcanic rocks.

FIGURE 4-1

Sensitivity of Bedrock and Derived Soils to Acid Precipitation in the Millbank Airshed


N
Miramichi Bay
Millbank TGS
Chatham
Newcastle
25 km
High sensitivity
High-Intermediate sensitivity
Low-Intermediate sensitivity

Reference: Shults, 1981

Agricultural soils in New Brunswick have been classified according to their susceptibility to acidification. Within the Millbank airshed, sensitivity ranges from sensitive to not sensitive in the area immediately surrounding the proposed Millbank TGS as illustrated in Figure 4-2. Most of the area within the airshed is unclassified.

Relative terrain sensitivity to acidification (i.e., sensitivity of non-agricultural vegetation) as shown in Figure 4-2, is indicated as intermediate to high as determined using the distribution of SO_2 - sensitive species (as cited in Hawkins and Tims, 1984).

Derived from data on soil chemistry and depth, vegetation cover, and underlying bedrock and parent material, Figure 4-2 illustrates the capacity of terrestrial components to neutralize acidic inputs to aquatic systems. Most of the area within the Millbank airshed is moderately sensitive as classified by this parameter, with a small area to the northwest of the TGS having low sensitivity (as cited in Hawkins and Tims, 1984).

4.2.1.5 Sensitivity of Surface Waters to Acid Precipitation

The sensitivity of New Brunswick lakes and rivers to acidification has been reported in a number of reports (as cited in Hawkins and Tims, 1984; Tims and Hawkins 1985; Tims, 1986). Seven drainage basins lie within a 50 km radius of the proposed Millbank TGS. The sensitivity of lakes to acid rain has been classified in only three of these drainage basins. The remaining four have yet to be classified. Based on alkalinity, low (200 - 499 μequivalents/L) to moderate (40 -199 μequivalents/L) sensitivities have been reported, as seen in Figure 4-3. Table 4-1 lists the lakes and rivers comprising each drainage basin.

Additional water quality data has been supplied by the Environmental Services Branch of the New Brunswick Department of the Environment. Sampling data for the following rivers indicate sensitivity to acidification as measured by pH. Available data varies from one single measurement to three measurements.

TABLE 4-1

Surface Waters Within The Millbank Airshed

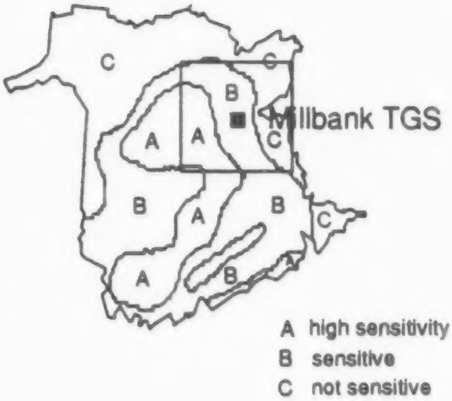
Drainage Basin	Lakes and Rivers
BQ	- all lakes and rivers not yet classified. Lakes: Bayles, Sinclair, Clearwater, Bills, Peabody, Clearwater Stream Rivers: Miramichi River (NW), Little Tomogonops Brook, Tomogonops River
BL	- lakes and rivers not yet classified
BO	Lakes: Upper Peak Mountain, Twin, Fish, Louis, Young Bull, Melville, Burnt. Rivers: Bartibog[1], Bartholomew[1], Barnaby[1], Renous[1]
BP	Lakes: Indian Braithwaite, North Bear, Holmes, Tuadook, Townsend Pond, Cleaver, Little Trousers, North Pole, Muskrat, Guages Lake Headwater, Headwater, Proule Ridge, Lizard Lake, Forks Mountain, Logan Lake, Senda Lake Headwater, Vixen Mountain, Half Moon, First Freeze, Second Freeze, Kenny, Goodwin, Nowlan Rivers: Reeds Brook, Sinclair Brook, N.W. Miramichi
BR	- all lakes and rivers not yet classified. Lakes: Jardine[2], Livain[2] Rivers: Kouchibouguac[1], Kouchibouguacis[1], Richibucto[1], Black[1], Nappan[1], Bay du Vin[1].
BN	- all lakes and rivers not yet classified.
BK	Lakes: Slack's, Clearwater Lake Headwater, First North Senogle River Lake, Second North Senogle River Lake, Nepisguit Rivers: Forty Mile Brook, Nepisguit

Table developed from Tims, 1986; and Hawkins and Tims, 1984.

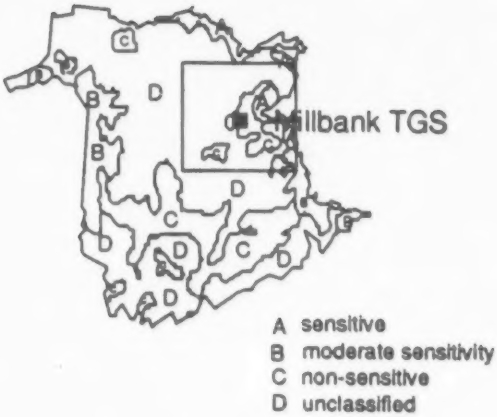
[1] additional information derived from sampling data carried out by New Brunswick Department of the Environment, Environmental Services Branch.

[2] Kerekes, 1977

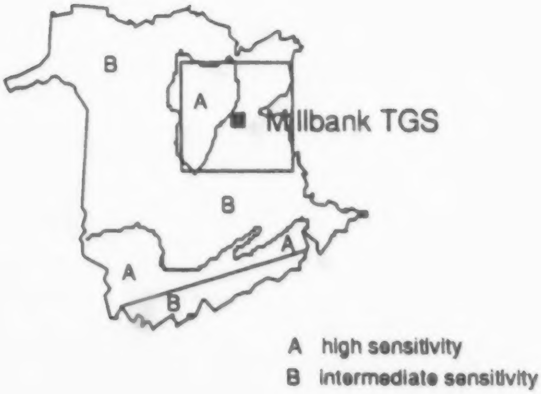
FIGURE 4-2


Millbank TGS
A high sensitivity
B sensitive
C not sensitive

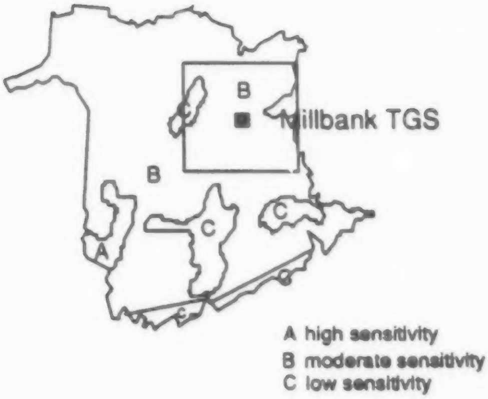
Sensitivity of surface waters using the Calcite Saturation Index *


Millbank TGS
A sensitive
B moderate sensitivity
C non-sensitive
D unclassified

Sensitivity of agricultural soils*


Millbank TGS
A high sensitivity
B intermediate sensitivity

Relative terrain sensitivity using the distribution of SO2-sensitive species *


Millbank TGS
A high sensitivity
B moderate sensitivity
C low sensitivity

Influence of terrestrial components, including soils, vegetation and geology, on aquatic sensitivity *

* as cited in Hawkins and Tims, 1984

TABLE 4-2

Aquatic Systems Sensitivity Category Criteria

Sensitivity Category	pH	Alkalinity		CSI
		mg/L	μeq/L	
Extremely Sensitive	≤ 5.5	≤ 1.9	≤ 39	≥ 4.00
Moderately Sensitive	5.6 - 6.5	2.0 - 9.9	40 - 199	3.00 - 3.99
Low Sensitivity	6.6 - 6.9	10.0 - 24.9	200 - 499	2.00 - 2.99
Not Sensitive	≥ 7.0	≥ 25	≥ 500	≤ 1.99

CSI = Calcite Saturation Index as reprinted from Tims and Hawkins, 1985.

River	Drainage Basin	Aquatic System Sensitivity
Tabusintac	BL	not sensitive
Barnaby	BO	not sensitive
Bartholomew	BO	not sensitive
Bartibog	BO	not sensitive
Renous	BO	not sensitive
Bay du Vin	BR	not sensitive
Black	BR	not sensitive
Kouchibouguac	BR	not sensitive
Kouchibouguacis	BR	low sensitivity
Nappan	BR	low sensitivity
Richibucto	BR	not sensitive

Of a total of five lakes evaluated in drainage basin BK, one was moderately sensitive, one had low sensitivity, and three were reported as not sensitive. Data for drainage basin BO include one lake as being acidified, two lakes extremely sensitive, and five lakes moderately sensitive. Thirty lakes were sampled in drainage basin BP. Of the thirty, two were classified as extremely sensitive, twenty-five as moderately sensitive, and 3 as low sensitivity. Although drainage basin BQ has not been classified (see Figure 4-3), some data have been reported. Of six lakes evaluated, five showed moderate sensitivity while one was reported as being not sensitive (Tims, 1986).

The tabulation used by Hawkins and Tims to classify rivers and lakes is presented in Table 4-2. Additional water quality data has been reported for two lakes in drainage basin BR (Kerekes, 1977). The pH data reported for each lake were used to determine aquatic sensitivity to acidification, also using the above criteria.

Lake	Drainage Basin	Aquatic System Sensitivity
Jardine	BR	extremely sensitive
Lavain	BR	extremely to moderate sensitive

The river data presented for drainage basis BR, indicate four out of six rivers sampled as being not sensitive with the remaining two having low sensitivity.

Hawkins and Tims (1984) also reported the sensitivity to acidification of surface waters in New Brunswick, as determined by the Calcite Saturation Index (CSI). As seen in Figure 4-2, sensitivity ranges from high in the west end to not sensitive in the east end of the airshed.

4.2.1.6 Flora and Fauna

The forests of this area lie within the Eastern Lowlands forest area of the Acadian Forest Region (Rowe, 1972). Generally this area has predominantly softwood stands of black spruce, red spruce and balsam fir, or mixed-woods stands in which these species are associated with eastern white pine, red maple, sugar maple, yellow birch and white birch (Rowe, 1972).

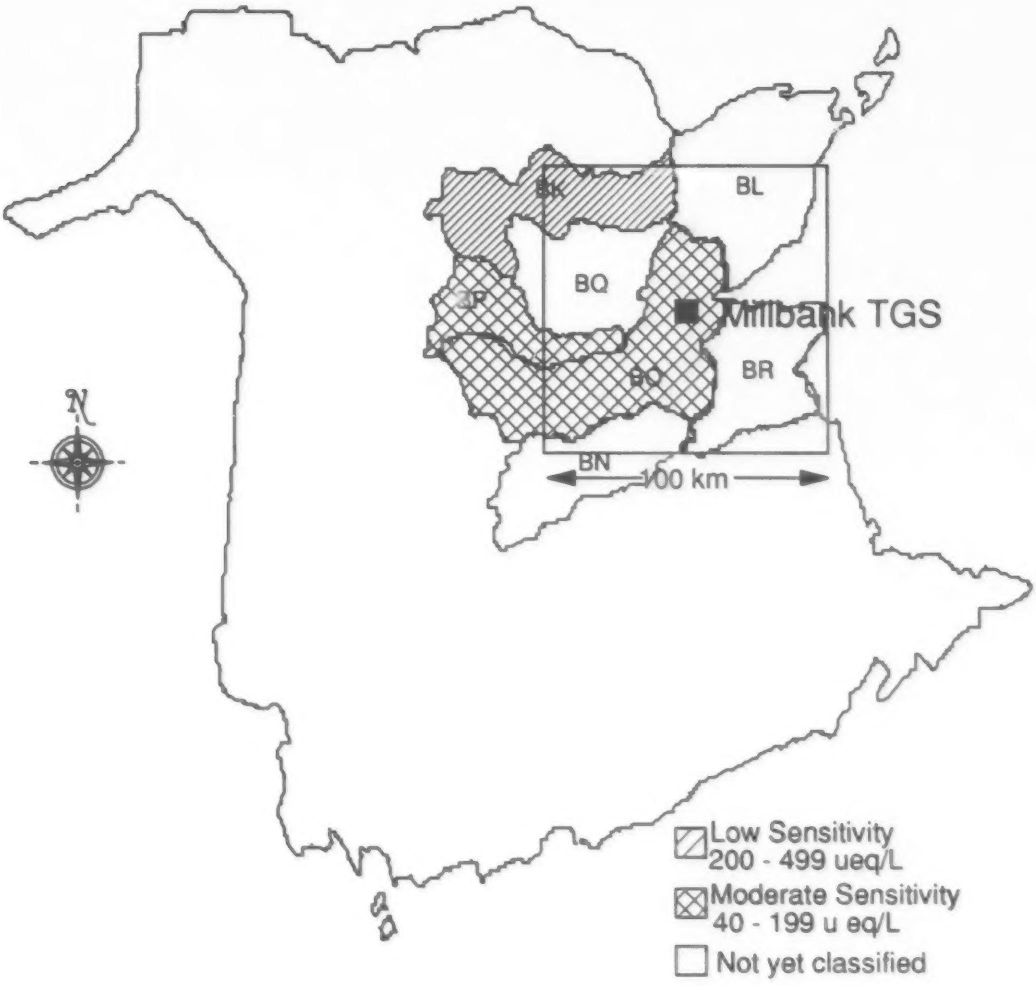
The site chosen for the location of the proposed generating station consists of a series of long, narrow private woodlots. These properties have had a long history of cutting for commercial tree species and/or firewood and represent a variety of successional stages as well as a variety of tree species. The tree species observed were all species one would expect to encounter in this area.

Several walkover site surveys of vegetation were conducted in spring and early summer 1990. These confirmed the nature of the vegetation as noted above and also the absence of unique habitats and rare or endangered species in the area to be cleared for the project.

Discussions with the New Brunswick Department of Natural Resources and Energy (NBDNRE) Newcastle office established that this area does not contain deer or moose wintering yards and a recent site visit supports this view. Both H. Hinds (University of

FIGURE 4-3

Sensitivity to Acid Rain Based on Median Alkalinity of New Brunswick Lakes by Drainage Basin


N
BK
BL
BQ
BP
Millbank TGS
BQ
BR
BN
100 km
Low Sensitivity 200 - 499 ueq/L
Moderate Sensitivity 40 - 199 u eq/L
Not yet classified

New Brunswick) and D. McAlpine (N.B. Museum) were contacted regarding any known occurrence of rare or unusual plant or animal species in the vicinity of the proposed development. This area is not known to contain any rare or unusual samples of flora and fauna. Due to the homogenous nature of the surrounding terrain and forest, it is highly unlikely that uncharacteristic species would be confined to this area.

Agricultural Crops

There is the potential of acid rain to effect agricultural operations. Within the Millbank airshed, a number of agricultural operations are conducted. Portions of Kent, Gloucester, and Northumberland Counties fall within the defined area of interest. As reported in the 1986 Statistics Canada Census of Agriculture for New Brunswick (Statistics Canada, 1987a), the following crops are grown in these three counties: grains, hay and fodder crops, oilseeds, others (such as tobacco and potatoes), tree fruits, berries and grapes, and vegetables. Livestock include poultry, cattle and calves, pigs, sheep and lambs, and others (such as horses and goats). There are also forest products and maple tappings operations present in these counties. Within the airshed, fourteen major Christmas tree farms have been identified. Their locations are indicated in Figure 4-4.

Rare Flora and Fauna

A number of environmentally significant ecosystems have been identified as habitats for rare plants upon which gaseous emissions might impact. Table 4-3 lists these ecosystems and the plants of concern. Figure 4-4 shows the location of each area.

Habitats for a number of bird species and/or endangered species have also been identified as environmentally significant ecosystems. Birds within the Millbank airshed can be significantly affected if they feed on plants that are particularly susceptible to acid rain. As well, sensitivity of the surface waters could impact terrestrial and aquatic organisms

TABLE 4-3

Location of Rare Plants in The Millbank Airshed

Ecosystem	Rare Plant Species
Bay du Vin Island	- site of rare plant *Distichlis spicata*[4]
Beaubears Island	- white pine stand[5]
Chatham/Newcastle area	- habitat for rare plants: Salmolus valerandi, Stellaria crassifolia, Sagittaria calycina var. Spengiosa[4]
Enclosure Provincial Park	- white pine stands[5]
Kouchibouguac National Park	- barrier sand dunes mainly colonized by beach grass *Ammophila brerviligulata* and wooly hudsonia *Hudsonia tomentosa*; good undisturbed representative of a barrier sand dune ecosystem[3]
Loggieville	- wet shores are habitat for rate plant *Montia fontana*[2]
Miramichi River Estuary	- site of rare plant *Epilobium ciliatum*[4]
Neguac and Neguac Beach	- site of rare plant *Cuscuta cephalanthi* (shore)[4]
Neguac Provincial Park	- coastal park[5]
Point Escuminac	- only site of plant Yellow Bartonia *Bartonia virginica* (L.) B.S.P.[1] and *Rhynchospora capillacea*[2]
Quarryville	- site of the small flowered Gerardia *Agalinus purpurea* (L.) Pennel var. *parviflora* (Benth.) Boivin, Riverweed *Podostemum ceratophyllum* Michx, Broad - leaved Ladies' tresses *Spiranthes lucida* (H.H. Eat.) Ames[1]
Stewart Brook	- tidal flats with rare plants: the Pipewort, *Eriocaulon parkeri* Robins, *Scirpus smithii* Gray, *Cyperus diandrus* Torr, *Cyperus rivularis* Kunth[1]
Strawberry Marsh	- vegetation[5]

[1] Dionne et al., 1988

[2] Hinds, 1983

[3] Canadian Committee for the International Biological Program, 1974

[4] Specified by the New Brunswick Department of the Environment

[5] Specified by the New Brunswick Department of Natural Resources and Energy

within the airshed. Table 4-4 lists the areas of concern while Figure 4-4 shows the location of each.

The following two sites, shown in Figure 4-4, should also be included in the list of potentially significant areas:

1. In addition to being a habitat for migratory birds, the Portage Island Wildlife Area is a fragile ecosystem excellent for the study of vegetation succession and the effects of wind (Dionne et al., 1988).

2. Square Forks is considered a critical natural area (Dionne et al., 1988), known for its beauty. The North and South Sevogle Rivers flow between sheer rock cliffs and form a "T" with the Big Sevogle river. The salmon run and salmon jumping can be seen in the fall (Dionne et al., 1988).

4.2.1.7 Groundwater Resources

Background Information

The characteristics of the groundwater resources in the Millbank area are not well documented. However, several sources of pertinent data were evaluated in the course of the study. A 1976 study by the New Brunswick Department of the Environment provides considerable information based on a study of over fifty wells. The report discusses the encroachment of salt water into aquifers in the area. It suggests that freshwater heads were reduced by local overpumping and that the overall rate of pumping exceeded the recharge available from infiltration. A 1983 report from the same source provided updated information based on additional work in the area. A 1989 report by the Prince Edward Island Department of Environment also provided information of interest. The geological strata on P.E.I. are similar, except for colour, to that found in the Millbank area.

TABLE 4-4

Importance of Environmental Areas to Terrestrial Organisms in The Millbank Airshed

Ecosystem	Environmental Significance
Bay du Vin Island	- 200 pairs Great Blue Heron, 5-10 pairs Osprey[2]
Egg Island	- 400-500 pairs Herring and Great Black-backed Gulls; 75 pairs Common Tern; 20-30 pairs Double-crested Cormorants[2]
Hay Island	- site of endangered Salt Marsh Copper Butterfly and multiple bird colonies possibly including Common Tern (600 pairs - questionable present status) and Red-breasted Merganser[2]
Kouchibouguac Northern Lagoon	- nesting site for small birds and an area for waterfowl during migration[1]
Miramichi River Estuary	- entire estuary, including the shoreline is utilized extensively by migrant shorebirds from July to September and by migrant seabirds and migrant waterfowl in spring and fall[4].
Neguac and Neguac Beach	- endangered Piping Plover nesting site (10 pairs); major nesting site for Common Tern and various gulls[2]
Portage Island Wildlife Area	- stopover area for migrating birds during spring and fall migration[1]; habitat for 5-10 pair Osprey and 200 pair Great Blue Heron[2]
Strawberry Marsh	- wildlife[3]
Tabusintac Beach	- nesting and feeding site for Piping Plover[2]
Tabusintac Blacklands	- largest nesting population of Osprey *Pandion haliaetus* (Linnaeus) in New Brunswick; also a Great Blue Heron *Ardea herodias* (Linneaus) colony[1]
Tabusintac Gully	- nesting sites for the Ring-billed Gull *Larus delawarensis* Ord and for the Common Tern *Sterna hirundo* Linnaeus[1]
Tracadie Bar	- 15 pairs of Piping Plover; 150 pairs of Herring and Ring-billed Gull[2]

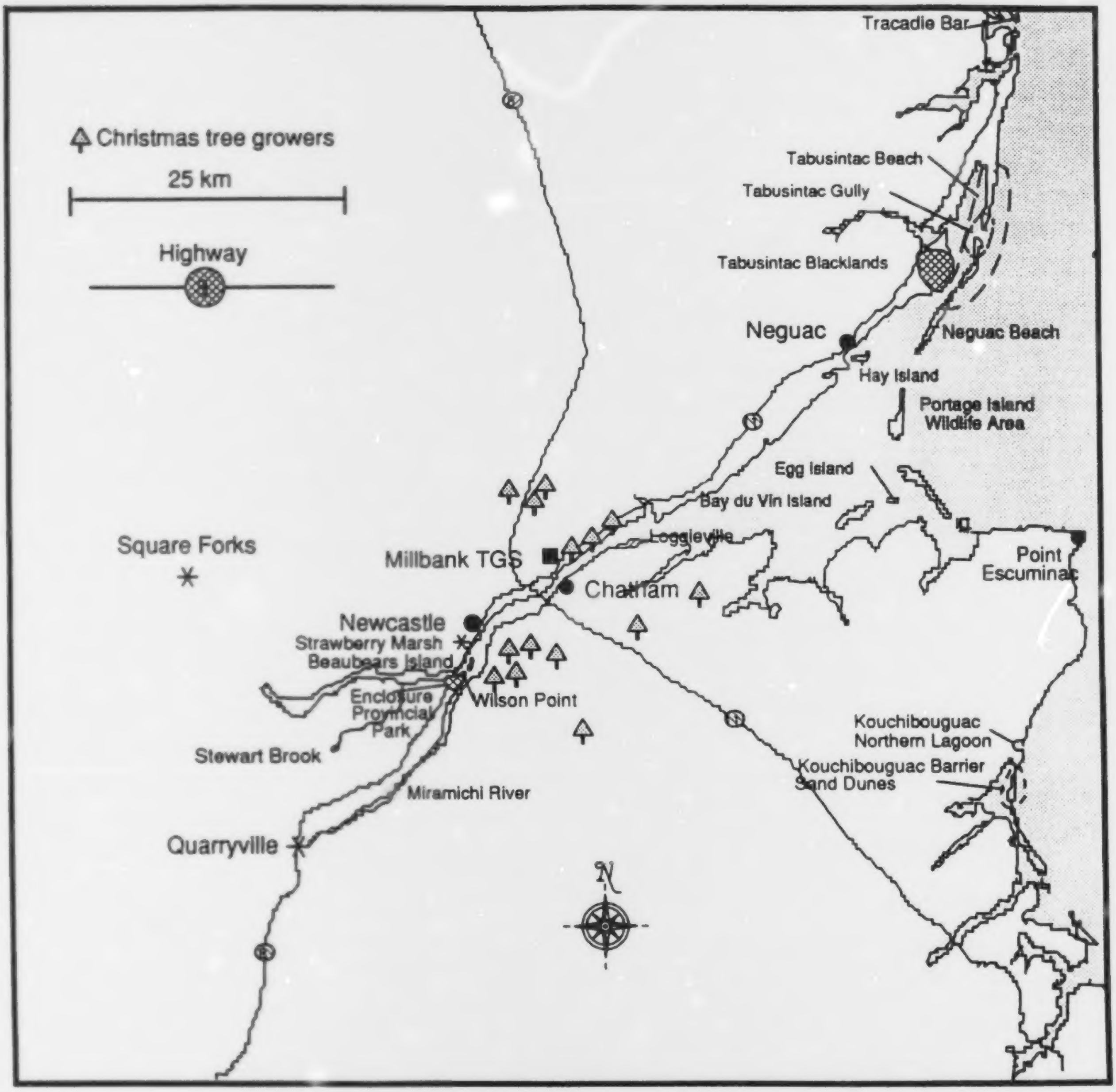
[1] Dionne et al., 1988

[2] Specified by the New Brunswick Department of the Environment, pers. comm., 1990

[3] Specified by the New Brunswick Department of Natural Resources and Energy, pers. comm. 1990

FIGURE 4-4

Environmentally Significant Areas in The Millbank Airshed


Christmas tree growers
25 km
Highway
Tracadie Bar
Tabusintac Beach
Tabusintac Gully
Tabusintac Blacklands
Neguac
Neguac Beach
Hay Island
Portage Island Wildlife Area
Egg Island
Bay du Vin Island
Loggieville
Point Escuminac
Millbank TGS
Chatham
Square Forks
Newcastle
Strawberry Marsh
Beaubears Island
Enclosure Provincial Park
Wilson Point
Stewart Brook
Miramichi River
Quarryville
Kouchibouguac Northern Lagoon
Kouchibouguac Barrier Sand Dunes
N

One of the principal factors which determines groundwater availability is the geological environment. Geological conditions have been reviewed in an earlier section of the report and can be briefly summarized as consisting of a thin layer of overburden overlying several hundred metres of sub-horizontal to gently dipping sedimentary rocks consisting primarily of sandstones and shales. These sedimentary rocks have a higher permeability than many of the rock units in the Province but would not be expected to yield the required quantities of water in normal circumstances. However, larger yields would be anticipated in association with fracture zones within the bedrock.

In order to evaluate the potential yields which could be expected, a review of the Drillers Log File, available through the Water Resources Branch of the New Brunswick Department of Environment, was conducted. A total of 63 wells were identified in the Millbank area. The wells ranged in depths from 15 to 54 m below ground level, with 85 percent of the wells being less than 30 m deep. A total of five wells in the Millbank area, three of which were less than 21 m deep, had estimated yields greater than 4 L/s. This data suggests that relatively high yield wells could be located in the area and that there may be potential for higher yields at depth. Stratigraphically, the driller logs reported that the rock formations intersected were mainly sandstones, with some shales present.

In the Chatham area, a well field consisting of six high yield municipal wells is located within a 2 km^2 area. The combined recommended yield for the well field was 63 L/s with individual yields ranging from 8 to 15 L/s (New Brunswick Department of Environment, 1983 and 1976).

The Town of Chatham has consistently attempted to upgrade the water quality of the town supply and at present appears to have been successful in finding sufficient groundwater with low mineral levels. Over pumping of wells within 600 m of the Miramichi Estuary resulted in an increase of total dissolved solids to above acceptable levels. As there are no records on pumping levels, it can only be assumed that the piezometric surface was drawn well below the River and subsequently, brackish water migrated towards the wells.

During the early 1980s local water quality studies were completed to determine if better water quality (i.e. low manganese) was available. On the basis of hydrogeological assessment an aquifer was identified and subsequent drilling and testing provided the Town with water which had low manganese and total dissolved solids.

At the conclusion of the data review, an evaluation of potential target areas for high yield wells in the Millbank area was subsequently conducted. Several topographic features were identified which potentially represented high water yield fracture zones. One such zone was evaluated by drilling a test hole at N.B. Power's existing McHardy Road Substation. Subsequently, a second test hole was drilled on another feature near the proposed development. Observation wells (two) were drilled and a pump test conducted to collect additional data on the groundwater resources in the area. One of the observation wells was drilled in the vicinity of residences nearest the proposed development and was intended to provide data on the potential impact of the development on local residential wells. The specifics of this groundwater evaluation program are discussed in a subsequent section.

Survey of Existing Wells

As a component of the investigation of groundwater resources in the study area, a survey of existing wells in the vicinity of the proposed development was conducted. This survey consisted of a door-to-door investigation of all buildings in the study area. A standard questionnaire form was used as illustrated in Figure 4-5. Since the exact location of the production wells and the potential drawdown distance was not known at the time of the study, a broad area was surveyed to ensure adequate coverage at a sufficient distance from the development. Figure 4-6 illustrates the extent of the area surveyed.

FIGURE 4-5

MILLBANK ENVIRONMENTAL IMPACT STUDY - QUESTIONNAIRE

Name:

Address/Location:

Building Type:
Residential____________
Commerical_____________
(Give details)_________
____
____

Well Construction Details:

Year Drilled______________

Depth_____________________

Depth of Casing___________

Estimated Yield
(driller)_________________

Site Location Sketch (position of well relative to house, street etc.)

Location Map Number_______________

Are there any problems with the existing water supply system?______

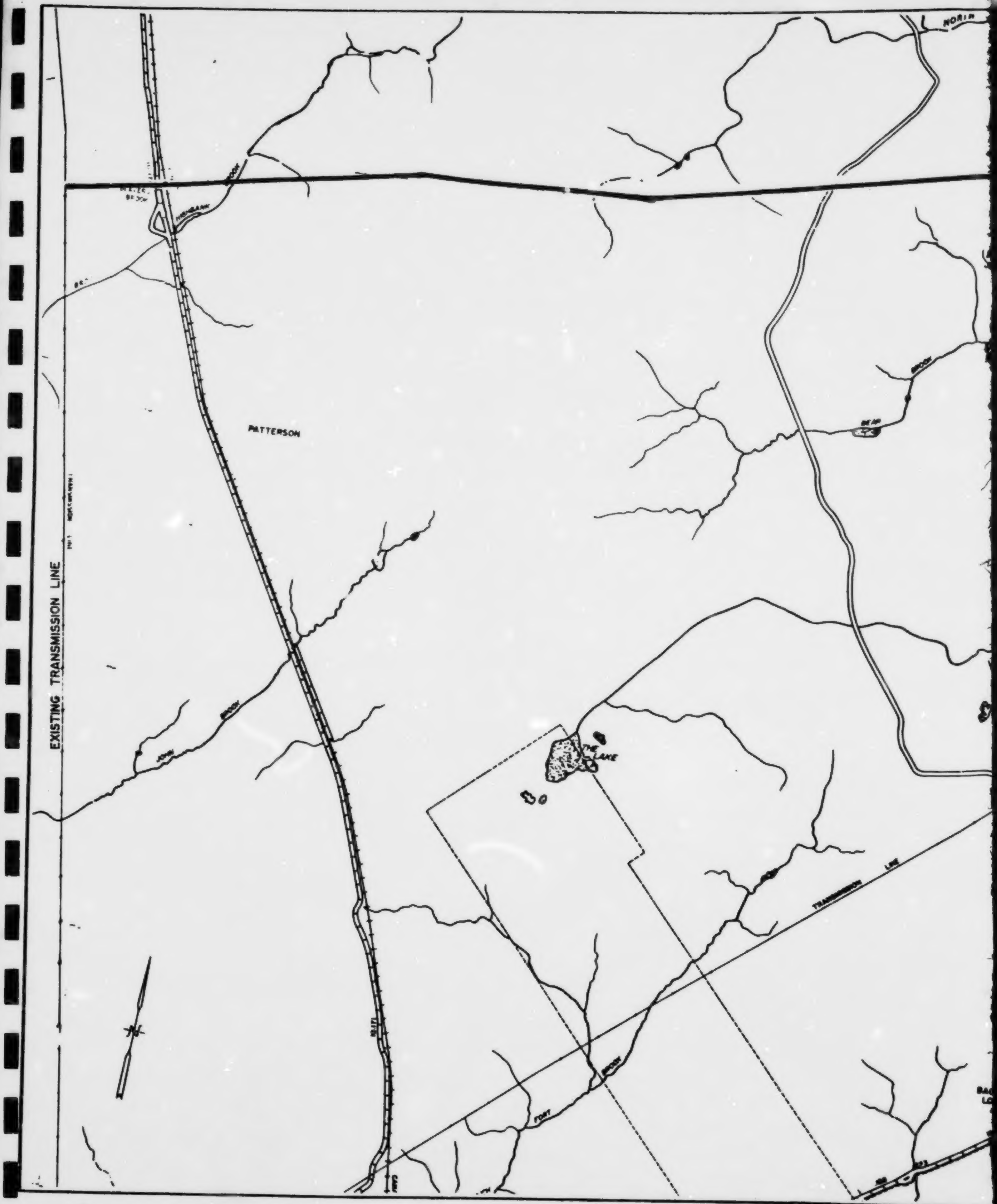
Give details____
____
____

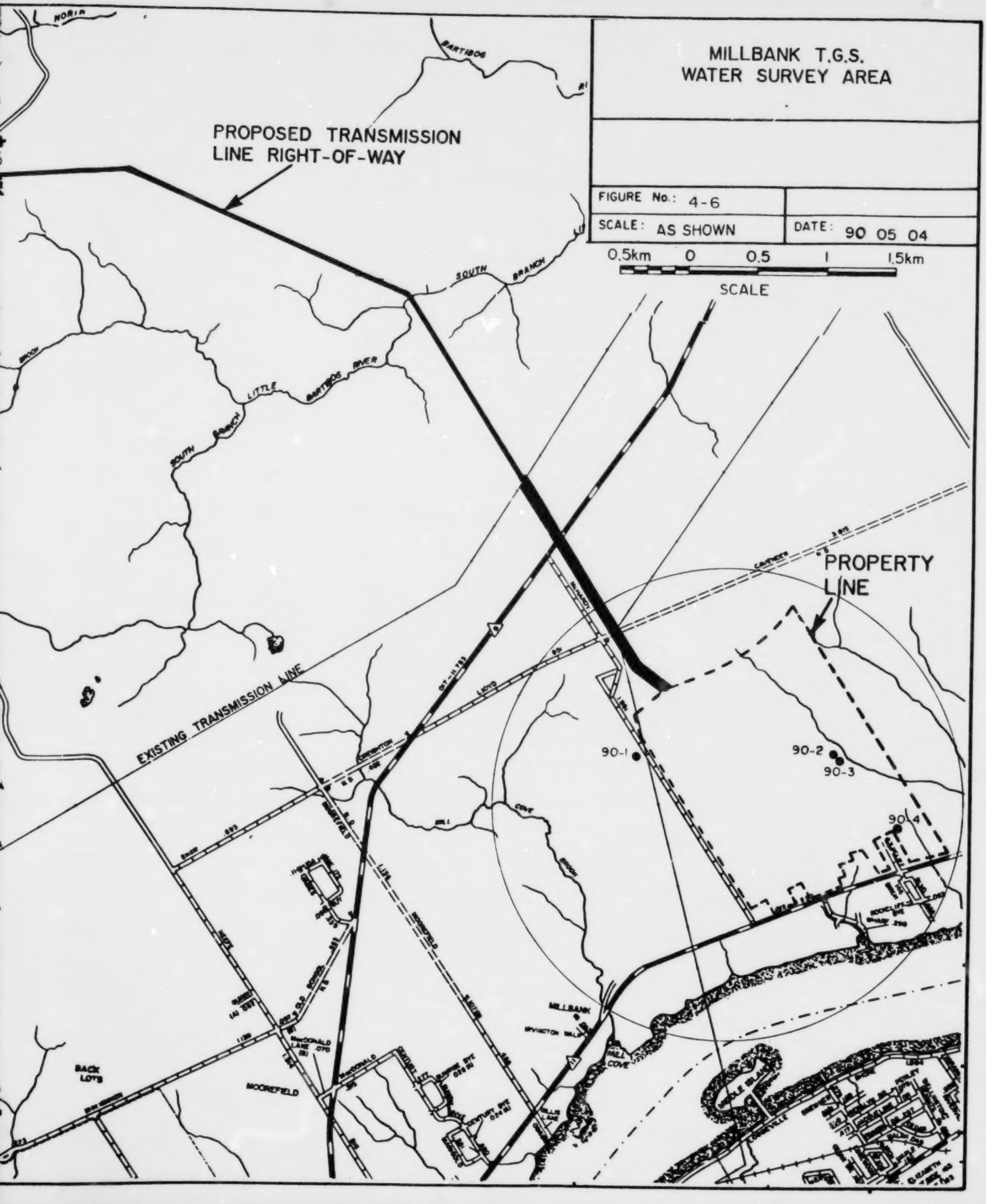
Are there fuel tanks, (if yes - size, number and product stored,) sewage lagoons or similar features on the property. Determine quantities and type of fertilizers and pesticides used.

____
____
____

Water sampled, Collected _____Yes _____ No Sample No.___________

Comments:____
____


NORIA
HIGHBANK BROOK
PATTERSON
EXISTING TRANSMISSION LINE
BEAR BROOK
JOHN BROOK
THE LAKE
TRANSMISSION LINE
FORT BROOK


PROPOSED TRANSMISSION LINE RIGHT-OF-WAY
EXISTING TRANSMISSION LINE
PROPERTY LINE
90-1
90-2
90-3
90-4
0.5km
0
0.5
1
1.5km
SCALE
SOUTH BRANCH
LITTLE BARTIBOG RIVER
BARTIBOG
MILL COVE BROOK
MILLBANK
MILL COVE
MIDDLE ISLAND
MOOREFIELD
BACK LOTS
NORTH

MILLBANK T.G.S.
WATER SURVEY AREA

FIGURE No.: 4-6

SCALE: AS SHOWN

DATE: 90 05 04

A total of approximately 60 buildings were located within the area to be surveyed. Although the survey was carried out over a period of several days, a few residents could not be located and a response was not obtained. Six residences, one church and a lumber yard were in this category. A total of 52 responses were obtained.

Water samples were collected at each of these locations, except for an occasional instance where permission was not given, and forwarded for analysis. The subsections which follow discuss the results of the survey.

Well Depths and Yields

The survey of buildings included both commercial establishments and private residences. In many cases, the occupant did not have an exact knowledge of well depths or yields but could give general information. Of the 45 respondents who were able to provide information, 7 wells were reported to have depths of 15 m or less, 19 were between 15 and 23 m, 13 were from 23 to 30 m and 6 wells exceeded 30 m. Well depths ranged from 8.5 to 49 m in depth. In general, estimates of yield could not be provided but comments such as 'good flow' and 'lots of water' were frequently made. The few estimates that were obtained indicated yields of 0.8 to 1.0 L/s.

Water Quality

Analytical results for private well water show that 36 percent of the wells sampled contained manganese levels higher than the level recommended by the Canadian Drinking Water Guidelines (0.05 mg/L). This recommended maximum level was established on an aesthetic basis rather then for health considerations. In addition, 12 percent of the wells had higher than acceptable levels of iron (0.3 mg/L). Levels of iron and manganese similar to those found at Millbank are common in the area. Finally, low pH values (<6.5) were detected in 14 percent of the wells. The level of nitrate+nitrite found in several private water supplies suggests some contamination by septic systems or excessive use of fertilizer in the local area. In general the nitrate+nitrite level in groundwater is less than 0.1 mg/L but several water systems (five) had concentrations greater than 3.5 mg/L.

Groundwater Evaluation Program

Drilling of test wells began on February 7, 1990 at N.B. Power's McHardy Road substation. Test well 90-1 (Figure 4-6) was constructed to obtain a general indication of the potential well yield and the water quality in the vicinity of the proposed development. The location coincided with a previously identified topographic feature which could represent a geologic fracture zone. The well was a 150 mm (6 in) diameter hole and was drilled by Green's Well Drilling Co. Limited under the supervision of Maritime Groundwater Inc. to a total depth of 90 m. Well casing was inserted to 5.5 m with a stick-up of 0.6 m. An overburden thickness of 3.6 m was intersected and this was underlain by 6.4 m of weathered olive-green sandstone which included some soft units and contained a small quantity of water (less than 0.5 L/s). Underlying this were alternating beds of brown and grey, medium grained sandstone. At a depth of 35 m, sandstone containing coal fragments was intersected and there was a corresponding increase in water production to 1.5 L/s. A fracture zone at 50 m gave the water a rust brown colour and increased the well yield to 60 L/s. Manganese staining, pyrite chips and small coal layers occur occasionally throughout the stratigraphy. Grey shale and mudstone units were interbedded with the sandstone throughout the bottom 50 m of the well. A total of 12-15 L/s was being air-lifted from the bottom part of the well at the conclusion of drilling.

Drilling continued on March 5, 1990 on the proposed development property. This stage of the evaluation involved the construction of three wells. Two of the wells, the test well (90-2) and an observation well (90-3), were drilled approximately 850 m from the main highway. A second observation well was drilled 200 m from Route 11 (Figure 4-6) in order to acquire information on the potential impact on the water table near residential wells due to aquifer development.

Test hole 90-2 was drilled to a depth of 90 m. The well was initially drilled at a diameter of 150 mm to evaluate the quantity of water present, then reamed to a diameter of 200 mm (8 in) to permit simulation of a production well during the pumping test. Twelve metres of 200 mm diameter casing was inserted through the overburden and the weathered sandstone. The upper 30 m of bedrock consisted of soft, medium grained sandstone which alternated from brown to grey in colour. Several fractures were intersected in the first 30 m of drilling which produced an estimated yield of 1.5 L/s. The zone from 30 to 60 m consisted of grey sandstone with thin layers of grey siltstone. Large fractures at depths of 43, 53 and 62 m increased the yield to 6-7.5 L/s. The lower 30 m consisted mainly of grey sandstone. Frequent small fractures increased the yield to over 11 L/s. Manganese staining was common throughout the stratigraphy while coal chips and pyrite flakes occurred occasionally.

The first observation hole (90-3) was drilled 6.5 m from test well 90-2. This well was drilled to a diameter of 200 mm for the first 12 m and 150 mm diameter casing was inserted. The remaining 78 m of the well was drilled to a diameter of 150 mm. The first 14 m consisted of overburden and soft brown weathered sandstone. Harder grey sandstone beds with small fractures followed but significant water yield was not observed. During drilling, pressurized drilling air was being returned up test well 90-2 indicating good hydraulic continuity between the two holes. A large fracture in soft brown sandstone at a depth of 27.4 m increased the well yield to 0.5-0.8 L/s. The rest of the well was drilled through grey sandstone with interbedded grey shale and clay. Manganese staining was common with occasional coal chips and pyrite flakes. After drilling to 90 m, the well yield had increased to over 11 L/s.

A second observation well (90-4) was drilled approximately 650 m from the test well. The first 6 m were drilled to a diameter of 200 mm and 150 mm casing was inserted and the remainder of the well was drilled to a diameter of 150 mm. The first 10 m consisted of overburden and soft brown sandstone, followed by 20 m of grey sandstone. A fracture intersected at 24 m had a corresponding yield at this depth of 6 L/s. Several smaller fractures increased water yield to 7.5 L/s at 32 m. The rest of the stratigraphy consisted of grey, medium grained sandstone interbedded with grey shales. Fracture zones at 44.5, 54 and 60 m were identified and the yield after the latter was estimated at 15 L/s. At the conclusion of the drilling, it was discovered that the well was artesian and was pushing water about 0.1 m above the casing. The flow rate was estimated to be over 27 L/s. The well was capped and a pressure valve installed to allow the well to be monitored during yield testing. Manganese staining, pyrite flakes and coal chips were occasionally observed throughout the stratigraphy. All the wells mentioned above were developed using air surging.

Pump Testing

A 72-hour pump test was conducted on well 90-2. The test started March 9, and was completed March 12, 1990. Test wells 90-1, 90-3 and 90-4 were used as observation wells during the test. The distances from the three observation wells to the pumping well were 1340, 6.5, and 650 m respectively. Due to artesian conditions at well 90-4, the pressure head was measured and subsequently converted to elevation head.

Step drawdown tests of 0.5 hours duration were conducted to determine an appropriate pumping rate for the constant rate test. The pumping rates for the three tests were 9, 15 and 21 L/s. The specific capacities for the tests were calculated to be 7, 6 and 4 L/s per m respectively, for a reduction of 25 percent between the first and last test. A pumping rate of 15 L/s was selected for the 72-hour pump test.

The pumping level in test well 90-2 stabilized at 4.46 m below static 24 hours into the test. The pumping rate was then increased to 19 L/s for the remainder of the pump test. At this pumping rate, the water stabilized 5.7 m below static in the pumping well. Drawdowns of 5.6 and 0.88 m were observed in observation wells 90-3 and 90-4 respectively at the end of the pump test. No drawdown was observed in observation well 90-1.

The aquifer transmissivity was determined (using the Thesis nonequilibrium equation) to be 227 m^2/day, with a corresponding storage coefficient of 5.8 x 10^{-4}. By comparison, transmissivity values for six production wells used by the Town of Chatham ranged from 27 to 338 m^2/day. Storage coefficient values for those wells ranged from 5 x 10^{-5} to 2 x 10^{-4}. The aquifer parameters calculated for test well 90-2 compare favourably to the Chatham wells.

The aquifer parameters determined above were utilized to calculate the expected distance-drawdown relationship for the 72 hour pumping period. The calculated drawdown (0.88 m) for a distance of 650 m from the pumping well corresponds favourably to that recorded at observation well 90-4 (0.7 m), confirming that the Theis method for determining aquifer parameters accurately models the response of the aquifer to pumping.

From the above parameters, a maximum safe yield of 1,400 L/min can be calculated for well 90-2. This would result in a calculated drawdown, based on 5 days of continuous pumping, of 9.1 m at the well. Drawdown at 500 m from the well was calculated to be 1.4 m, and at 750 to be 1.0 m. This level of drawdown does not incur a risk of salt water intrusion into the well."

Regional Hydrogeology

Surface topography in the study area slopes south toward the Miramichi River, at an average gradient of 4.5 percent. Groundwater flow direction can generally be approximated by surface drainage, and is therefore expected to be towards the River.

An elevation survey was performed to determine relative groundwater elevations in the area. These elevations can then be used to estimate groundwater flow direction and velocity. The elevations above sea level for the water table are presented in Table 4-5.

TABLE 4-5

Groundwater Elevations
(metres above sea level)

Test Hole	Surface Elevation	Depth to Water	Groundwater Elevation
90-1	79.36	-16.86	62.50
90-2	59.42	-13.63	45.79
90-3	59.40	-13.63	45.77
90-4	35.50	+ 3.34	38.84

Test holes 90-2, 90-3 and 90-4 are believed to be located on the same fracture system, while test hole 90-1 is thought to be on a separate system. A water gradient of 1.1 percent was calculated from groundwater elevation in test holes 2 and 4. This gradient is significantly less than the slope of the ground surface.

Hydraulic conductivity for the aquifer can be estimated at 2.9 m/day from the transmissivity values obtained from the pump test. Assuming an effective porosity of 0.5 percent (Prince Edward Island Department of Environment, 1989), a groundwater velocity can be estimated using the above hydraulic gradient and Darcy's Law. Darcy's Law was originally derived for flow through porous media. In highly fractured bedrock, however, the fracture density approximates porous media characteristics, and Darcy's Law can be used to estimate groundwater velocity.

Darcy's Law is generally expressed as follows:

$$V = \frac{K}{n}\frac{dh}{dx}$$

where: V = groundwater velocity

K = hydraulic conductivity

n = effective porosity

$\frac{dh}{dx}$ = groundwater gradient

A groundwater velocity of 6.4 m/day was calculated using the above parameters. The groundwater flow would be expected to be in a southerly direction, toward the Miramichi River.

4.2.2 Transmission Line Routes

Three transmission lines (Figure 3-6) will be used to connect the Millbank generating station to two nearby existing transmission lines. All three of the new lines will travel in a northwesterly direction from the site for approximately 3 kilometres where two of the lines will connect with the existing 138 kV line (No. 1106). The third line will then run due west to connect with the existing 230 kV transmission line (No. 2131) north of Newcastle.

4.2.2.1 Surficial and Subsurface Geology and Topography

The surficial and subsurface geology under the proposed transmission line routes is similar to that at the proposed plant site; Carboniferous Age light brown to grey and occasionally reddish interbedded sandstones, shales and conglomerates overlain by glacial till deposits of sand, clay and boulders and thin layers of marine deposits.

The topography in the area is gently rolling hills which grade down to near sea level along the Miramichi River. The elevation along the proposed transmission line is about 75 m near the proposed plant site, sloping up to between 90 and 105 m along the east-west trending portion of the transmission line, and decreasing in elevation to 80 to 90 m about one kilometre before the intersection of transmission line no. 2131.

4.2.2.2 Flora and Fauna

In general the proposed route consists of cleared areas, low density forest cover and bogs at the headwaters of several streams. Tree cover is primarily trembling aspen, white birch, white spruce, black spruce, white pine, red maple and white cedar. These species are all characteristic components of the Acadian Forest Region. There are no known plants or animals in the vicinity of the proposed route that can be considered rare or endangered (H. Hinds, D. McAlpine). Inquiries with DNRE in Newcastle indicate that there are no known deer or moose winter yards, or other critical wildlife habitat, in the vicinity of the proposed route. The transmission line corridor will cross the headwaters of several streams including the South Branch of the Little Bartibog River, and possibly a headwater tributary of this stream. Depending upon the exact routing of this transmission line, one or more first order tributaries of the North Branch of Little Bartibog may also be crossed as well as the headwater tributaries of Highbank Brook, a tributary of the Northwest Millstream. Both the Northwest Millstream and the Little Bartibog River support very important brook trout fisheries for both resident and sea-run trout. Atlantic salmon spawn in both of these systems. The salmon are fall run fish and enter these systems after the angling period. They therefore do not provide much angling opportunity but the juvenile salmon spend 2-3 years in these streams before migrating to sea. Smelt also spawn in the lower sections of these streams as well as lamprey eels. Threespine stickleback are known to occur in the Little Bartibog River.

4.3 Aquatic Environment

4.3.1 Miramichi Bay

The Miramichi River system (Figure 3-1 and 4-4) is the largest and most important river system of northeastern New Brunswick. It extends inland approximately 160 km from the head of the tide and drains an area of nearly 14,300 km^2. Miramichi Bay at the mouth of the river is roughly triangular in shape, 25 km long, and is separated from the outer estuary by a chain of islands. The outer estuary extends an additional 12 km out from this chain of islands to a line joining Escuminac Point to Blackland Point. The maximum depth of the outer estuary is 20 m, and within the bay 16 m. Most of the Bay is only 4-6 m deep with a deeper shipping channel running through it. Tidal influence exists in both main branches of the River (the Northwest and Southwest Miramichi Rivers) to a point approximately 25 kilometres upstream of Newcastle (McKenzie, 1959).

McKenzie (1959) documented the presence of 78 species of fish inhabiting the waters of the Miramichi system. Of this total, 53 species are marine, 7 anadromous, 1 catadromous and 17 are freshwater.

In 1976, Montreal Engineering Company, Limited completed a study of the fishery resources of the Miramichi estuary. The purpose of the study was to compile baseline information on the fisheries resources of the estuary, in order to evaluate the impacts of future dredging of a shipping channel to permit the passage of large ocean-going vessels upriver as far as Newcastle.

The compendium provided information on the status of various species in the estuary, their biology, degree of exploitation, fishing gear as well as management strategies of the fisheries resources of the Miramichi estuary. The compendium also identified sources of pollution entering the estuary as well as the effects of the various pollutants on the fisheries. A comprehensive annotated bibliography of the species, the fisheries and the environmental implications of dredging was compiled as part of the study.

The information in the compendium was collected through a review of published information on the species and fisheries of the estuary. Additional information was provided by various provincial and federal government agencies as well as interviews with fisheries officers and local fisherman.

This compendium has formed the point of departure for subsequent fisheries investigations. A later study by MacLaren Atlantic Limited (1978), included comprehensive field studies of fisheries in the Miramichi estuary, and in particular of the various proposed ocean dumping sites for dredge spots for the channel deepening. More recently, following completion of the dredging work and the various monitoring studies carried out before, during, and after the dredging, the fisheries findings were summarized by Seatech Investigation Services Ltd. (1986).

In documenting the fisheries resources of Miramichi estuary during the course of the Millbank Thermal Generating Station EIA, DFO Thermal Generating Station EIA, DFO fishery officers were interviewed and were able to update to the present time information contained in the compendium and the associated studies.

These discussions indicated that there are 14 fish species, 2 species of crustacean, 6 species of mollusc and 1 aquatic plant that are harvested commercially in the estuary. The current value of the total commercial fishery is more than 5 million dollars. The seasons for the various commercial fisheries are presented in Table 4-6.

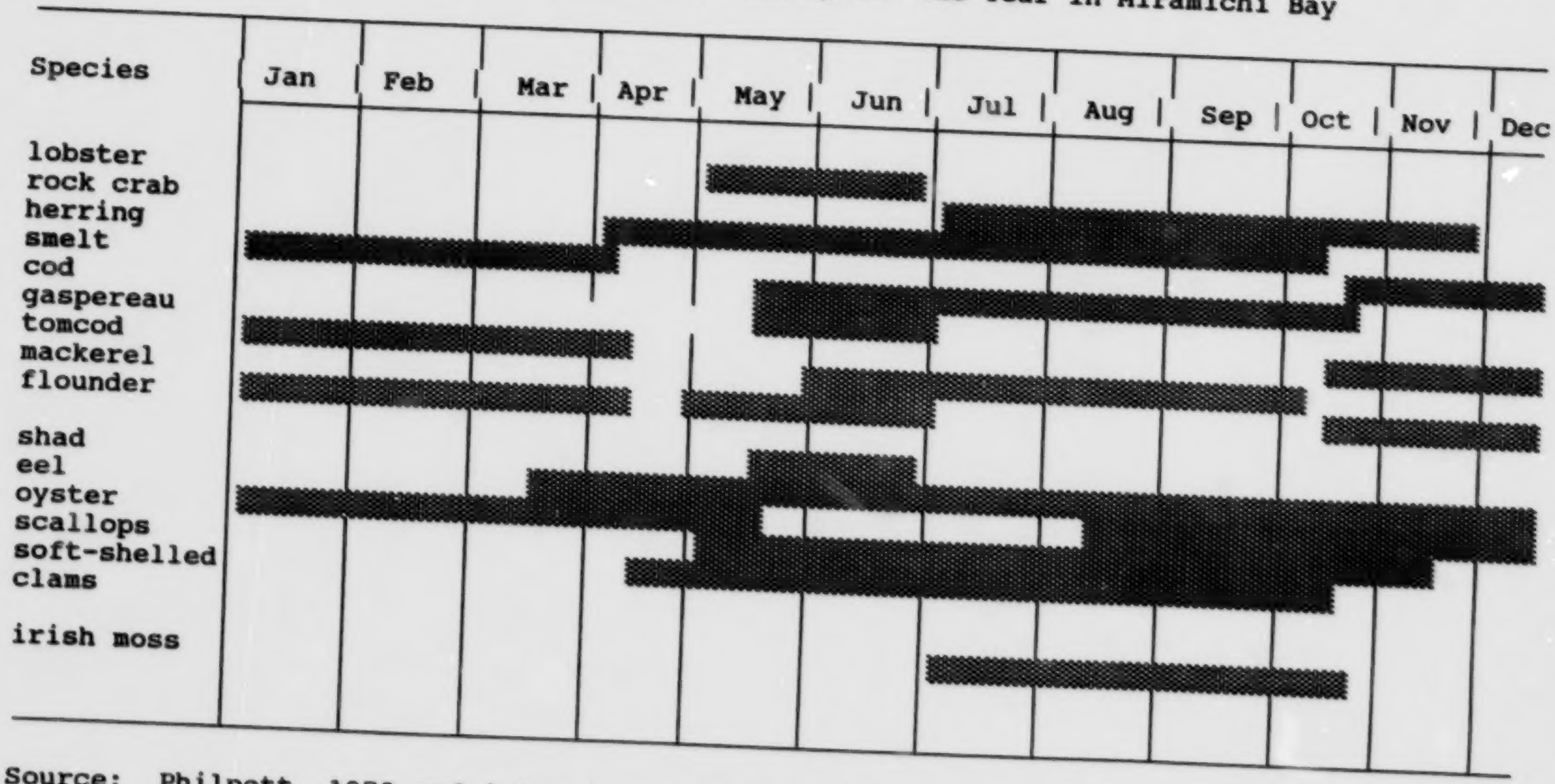
4.3.2 Big Brook

In spite of its name, Big Brook is a relatively small stream that drains the land in the vicinity of the proposed generating station. It has a total drainage area of 430 ha and a maximum width of approximately 2 m. Brook trout are believed to inhabit this stream. Rainbow smelt historically have used the lower section of Big Brook for spawning (McKenzie, 1964) and probably continue to do so. Both brook trout and smelt spawning occur in most small streams in this area. There is no sport fishery associated with this stream due to its small size. The tributary of Big Brook that dissects the site has a drainage area of 250 ha of the 430 ha. Visual observation of this stream on 2 May 1990 found that it had a significant flow due to snowmelt. At the same time, newly hatched brook trout fry were observed in this tributary approximately midway along its length.

The survey of fish populations in Big Brook was conducted on 4 July 1990. This survey was done at two sites using standard electrofishing procedures. Site 1 was in the west branch of Big Brook adjacent to the corner of the field north of Rockcliffe Subdivison. Site 2 was in the mainstem just south of Highway 11. At each site, a representative section of stream habitat was enclosed using small mesh barrier nets. At Site 1, only 72 m^2 of stream habitat was sampled due to the difficulty in clearing overhanging vegetation. At Site 2, 165 m^2 of stream habitat was sampled. Fish were collected from within the

TABLE 4-6

Commercial Fishing Activity Throughout the Year in Miramichi Bay



Source: Philpott, 1978 and interviews with DFO fisheries officers (Fisheries and Oceans, 1990) enclosed areas by using a Smith-Root Model VII electrofisher and dipnets. Three sweeps were made through each area in order to capture a high proportion of the resident fish populations. After each sweep, the captured fish were identified and counted, and after being anaesthetized, salmon and trout were measured for fork length to the nearest millimetre. When the final sweep was completed, and the data was collected, all of the captured fish were released back into the areas.

The results of the electrofishing surveys are presented below. At Site 1, brook trout was the only species found. They occurred at moderate densities, 55.3 trout (all ages) per 100 m^2 stream habitat. At Site 2, three species of fish were encountered; brook trout, Atlantic salmon and slimy sculpin. At Site 2, brook trout occurred at high density, 91.9 trout (all ages) per 100 m^2 of stream habitat, while salmon and sculpin occurred at more moderate densities, 19.8 (all ages of salmon) and 32.1 fish per 100 m^2, respectively. It is likely that the density of 0+ salmon and trout were underestimated due to the small size of the fish at this time of year and their ability to pass through the barrier nets.

Electrofishing Results for Two Sites Sampled in Big Brook on 4 July 1990

Species	Age	Number of Fish/100 m^2 Site 1	Number of Fish/100 m^2 Site 2
Brook Trout	0+	35.4	60.7[(a)]
	1+	17.0	33.1
	2+	1.4	3.7
	Total	55.3	91.9
Atlantic Salmon	0+	-	0.6[(a)]
	1+	-	18.0
	2+	-	0.6
	Total	-	19.9
Slimy sculpin		-	32.1

Population estimates are based on Delury (1951) formula
(a) probably underestimated

The electrofishing survey of Big Brook indicates that brook trout inhabit the upper reaches of this stream where the stream is narrow (1-2 m) and choked with overhanging vegetation (mainly alders). In the wider, more accessible lower section of Big Brook (in the vicinity of Highway 11), dense populations of brook trout share the habitat with juvenile Atlantic salmon and sculpin. Although rainbow smelt were not captured during this survey, they are also known to inhabit this section of the stream at spawning time. For example, on 20 May 1990, several hundred smelt were observed spawning in the section of Big Brook immediately downstream of Highway 11. The presence of three age classes of salmon in the brook suggest that they regularly spawn here. It is likely that the spawning run consists of only a few fish that enter Big Brook very late in the fall.

4.3.3 Little Bartibog River

The proposed route for the 230 kV transmission line will cross the South Branch of Little Bartibog River as well as a headwater tributary of the south Branch of Little Bartibog River. This system is known to contain brook trout (both native and sea run), Atlantic salmon and threespine stickleback. Smelt spawn in the lower section of Little Bartibog during May. This stream receives a great deal of angling pressure for brook trout and most of the angling occurs downstream of the bridge at Route 8. There is no angling opportunity for salmon since they enter the stream to spawn late in the fall after the angling season has closed.

4.4 Atmospheric Environment

Regional and local climatic conditions influence the atmospheric dispersion processes of industrial emissions. In view of this, an understanding of the long-term climatic patterns and the short-term, site-specific meteorological conditions will assist in the assessment of the likely impact of atmospheric emissions on regional and local air quality. A general overview of the climatology of the Millbank region is presented in this section. The overview is based on the climate normals for Chatham Airport, the AES climatological station with comprehensive meteorological data nearest to the proposed Thermal Generating station (TGS) at Millbank. This is followed by a description of the air pollution meteorology of the Millbank area. Information on existing airshed emissions and a review of the limited historical air quality data in the area are provided.

4.4.1 General Climatology of the Region

A long record of reliable data is required in order to define the climate of a region. Climate normals, which are based on a thirty year period of record, can be used to give an indication of the regional climate. The principal Atmospheric Environment Service

(AES) climatological station nearest to the proposed Millbank TGS is located at Chatham Airport, 5 km SSW of the proposed Millbank TGS.

The Chatham Airport station became operational in January 1943. The anemometer tower was relocated in 1953, 1962 and in September 1967 - to its present location. The published normals for Chatham (AES, 1984) caution that due to the presence of buildings close to the tower, some of the wind observations at the site may not be representative of the surrounding countryside. The wind anemometer has been placed at heights of 18.3 m (October 1946 to July 1953), 18.6 m (July 1953 to September 1962) and 24.4 m (June 1962 to September 1967). Since September 1967, it has been at the standard height of 10 m and in a location that will provide representative wind data. The wind data used for modelling studies (1979 - 1988 and 1984 to 1988) therefore are representative.

The meteorological station at Chatham Airport (47° 01' N, 65° 27' W) is situated at Canadian Forces Base (CFB) Chatham, located 1.5 km southeast of the town of Chatham, southwest of Route 11. The Chatham Airport station is located 3 km south of the Miramichi river and 2 km north of the Napan River. The site is at an elevation of 34 m above sea level and is in the shallow valley of the Miramichi River. The terrain surrounding the site of the meteorological station is generally flat where the highest elevation within 5 km occasionally exceeds 60 m. Elevations of up to 215 m occur well beyond the valley to the northwest and west.

Climate normal data and Principal Station Data for Chatham (AES, 1984) refer to a record length of 30 years (1951-1980) except where noted otherwise. The climate normals for temperature, precipitation, humidity, pressure, wind, and sunshine are listed in Table 4-7 and are discussed below. The mean number of days with the occurrence of temperature (in various ranges), precipitation (rain, snow and the total in various ranges), thunderstorms, freezing precipitation, smoke or haze, and fog are listed in Table 4-8.

4.4.2 Precipitation

The precipitation regime for Chatham Airport is summarized in Tables 4-7 and 4-8. The precipitation data are illustrated in Figure 4-7 as a bar graph plot of the mean monthly precipitation (segmented into rain and snow contributions) at Chatham Airport for the period 1951-1980. As indicated by the thirty-year data, the annual mean total precipitation is 1096.7 mm (total water equivalent of snowfall plus rainfall), of which 760.6 mm (69.4%) falls as rain. The total precipitation is well distributed throughout the months in the year both in terms of amount (a monthly range of 81.9 to 107.9 mm), and the number of days with precipitation (a range of 11 to 16 days per month with total precipitation >0.2 mm). The largest amount of total precipitation occurs in December. Rainfall is highest in October and snowfall in December. Reported thunderstorms are confined to the months May through September. Freezing precipitation occurs between November and April and is most frequent in December and January.

4.4.3 Winds

A summary of the wind data for Chatham is included in Table 4-7. The predominant winds at Chatham are from the south west (SW). The mean annual wind speed is 14.7 km/h. Mean wind speeds are highest during March and lightest during August. There

TABLE 4-7

Climate Normals, Chatham Airport, 1951 - 1980[1]
Means of Temperature, Precipitation, Humidity, Pressure, Wind and Sunshine

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TEMPERATURE (°C)													
Maximum	-4.5	-3.2	1.6	7.9	15.5	22.0	25.2	24.0	18.9	12.2	5.0	-2.2	10.2
Minimum	-14.8	-14.2	-8.2	-2.0	3.5	9.4	13.1	11.9	7.0	1.9	-3.3	-11.5	-0.6
Mean	-9.7	-8.8	-3.3	3.0	9.5	15.7	19.2	18.0	13.0	7.1	0.9	-6.9	4.8
Extreme Maximum	13.6	12.2	22.8	26.1	35.3	36.7	36.7	37.8	32.2	27.8	21.1	16.1	37.8
Extreme Minimum	-33.9	-35.0	-29.4	-17.2	-8.9	-2.2	2.8	0.6	-5.0	-8.9	-18.9	-30.0	-35.0
PRECIPITATION													
Rainfall (mm)	34.4	22.1	27.4	48.9	79.1	82.0	91.0	83.5	85.2	92.5	75.4	39.1	760.6
Extreme in 24 h	57.7	53.8	50.3	59.9	58.2	47.5	81.3	66.5	72.9	63.2	64.5	49.3	81.3
Snowfall (cm)	66.5	64.8	67.7	33.0	2.7	0.0	0.0	0.0	0.0	3.1	26.2	69.1	333.1
Extreme in 24 h	44.5	42.7	53.8	58.2	16.8	T	0.0	0.0	0.5	15.5	35.6	58.7	58.7
Total (mm)	98.8	86.8	97.1	84.5	81.9	82.0	91.0	83.5	85.2	95.6	102.4	107.9	1096.7
Extreme in 24 h	58.2	53.8	62.0	59.9	58.2	47.5	81.3	66.5	72.9	66.3	64.5	55.9	81.3
HUMIDITY													
Dew Point (°C)	-12.5	-12.1	-7.1	-2.3	3.6	9.7	13.2	12.5	8.1	3.0	-2.1	-9.6	0.4
Relative Humidity (%)	79	77	75	73	71	71	73	74	75	77	81	80	76
PRESSURE													
Sea Level (kPa)	101.2	101.2	101.2	101.3	101.4	101.2	101.2	101.3	101.5	101.5	101.4	101.3	101.3
WIND													
Prevailing Direction	W	W	W	NE	SW	SW	SW	SW	SW	SW	W	W	SW
Speed (km/h)	15.3	15.7	16.6	15.3	14.9	14.6	13.2	12.8	13.7	14.4	14.7	15.2	14.7
Peak Wind (km/h)	105	106	113	103	129	116	89	97	135	105	121	143	143
SUNSHINE													
Bright Sunshine (h)	113.7	131.0	146.1	172.4	209.5	228.8	253.1	237.6	178.9	141.9	98.9	98.4	2010.3
% of Possible	40.9	45.2	39.7	42.4	45.0	48.2	52.7	53.9	47.3	41.9	35.0	36.9	45.0

[1] Atmospheric Environment Service, 1984

T = trace amounts < 0.2 cm

TABLE 4-8

Climate Normals, Chatham Airport, 1951 - 1980[1]
Mean Number of Days with Ocurrence of Temperature and Precipitation in Various Ranges and Thunderstorms, Freezing Precipitation, Smoke or Haze and Fog

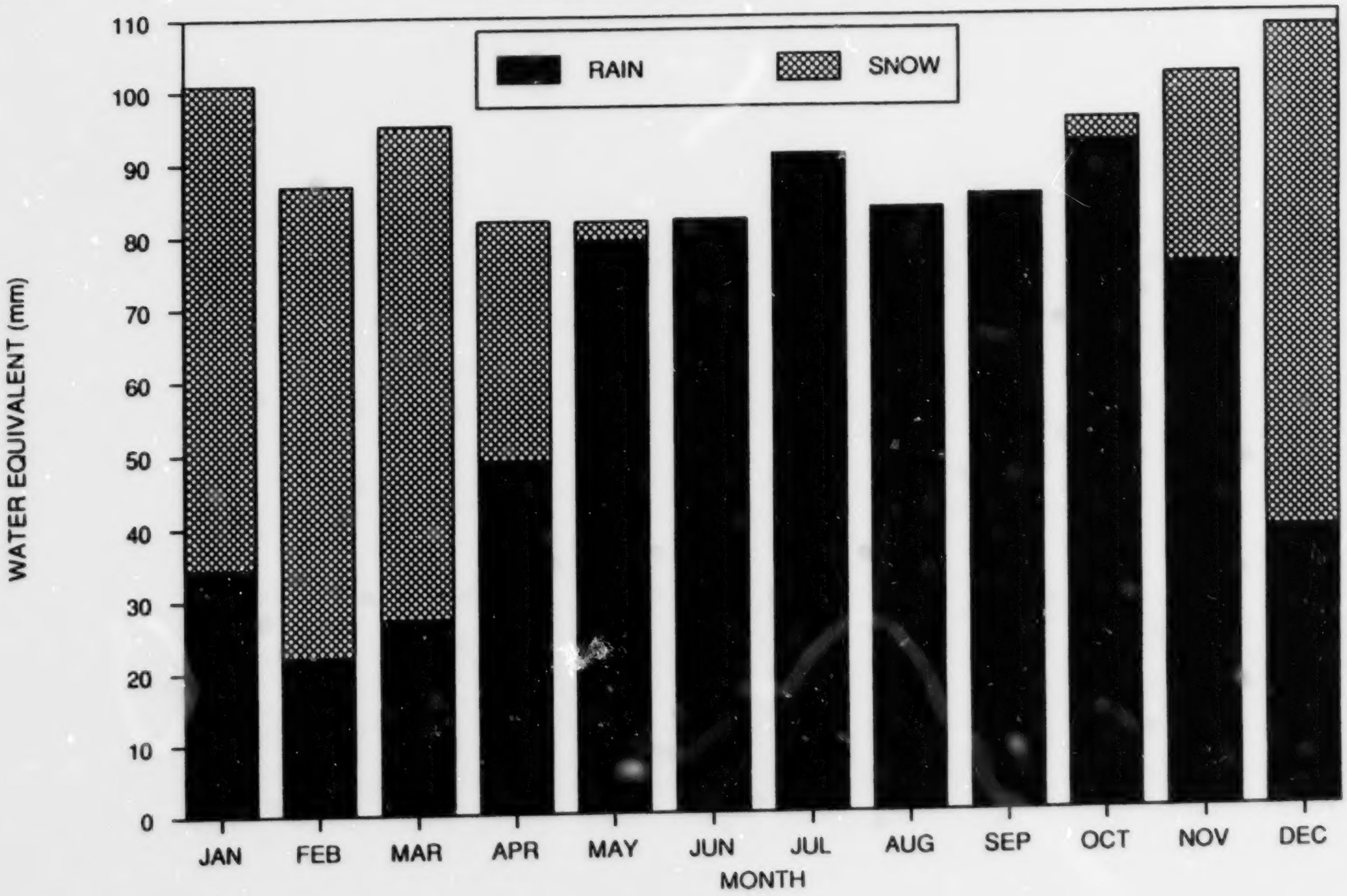
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TEMPERATURE (MAX)													
> 0°C	7	8	19	29	31	30	31	31	30	31	25	11	283
> 18°C	0	0	*	1	10	22	29	28	17	4	*	0	111
> 30°C	0	0	0	0	*	2	4	2	*	0	0	0	8
> 35°C	0	0	0	0	*	0	*	*	0	0	0	0	*
TEMPERATURE (MIN)													
≤ 0°C	31	28	29	22	7	*	0	0	2	12	23	30	184
> 0°C	1	*	2	8	24	30	31	31	28	19	7	1	182
< -2°C	29	27	26	14	2	0	0	0	*	6	18	28	150
< -20°C	8	6	1	0	0	0	0	0	0	0	0	4	19
< -35°C	0	0	0	0	0	0	0	0	0	0	0	0	0
PRECIPITATION (RAIN)													
≥ 0.2 mm	5	3	5	8	13	13	13	13	11	12	10	6	112
(SNOW)													
≥ 0.2 cm	14	12	11	6	1	0	0	0	0	1	6	12	63
≥ 1 cm	10	9	8	5	1	0	0	0	0	1	4	9	47
≥ 10 cm	2	2	2	1	*	0	0	0	0	*	1	2	10
(TOTAL)													
≥ 0.2 mm	16	13	14	12	13	13	13	13	11	13	14	15	160
≥ 10 mm	3	3	3	3	3	3	3	2	3	3	3	4	36
≥ 12 mm	2	2	3	2	2	2	2	2	2	3	3	3	28
≥ 25 mm	1	1	1	1	1	1	1	1	1	1	1	1	12
THUNDERSTORMS	*	0	*	*	2	3	5	4	1	*	*	0	15
FREEZING PCPN	4	3	3	1	0	0	0	0	0	*	1	3	15
SMOKE OR HAZE	2	2	1	2	2	5	9	7	4	4	2	2	42
FOG	2	2	3	4	4	4	5	4	4	4	5	3	44

[1] Atmospheric Environment Services, 1984

* = Denotes at least one observation during the period of record.

FIGURE 4-7

Precipitation Normals [1]
Chatham Airport (1951-1980)



[1] Based on data from Atmospheric Environment Service, 1984

is little seasonal dependence of the prevailing wind direction since the prevailing winds by month are from either the SW (seven months) or W (four months). In the remaining month the prevailing wind is from the NE. The highest gust wind speed in the thirty year period was 143 km/h. The highest mean hourly wind speed in the period was 89 km/h (see Table 4-9).

More detailed information on the wind regime of Chatham Airport is summarized in Tables 4-9 and 4-10 and are illustrated in Figure 4-8.

During the winter months (December, January and February) when the Millbank TGS is likely to be in operation most frequently, the prevailing winds are from the SW, WSW and W respectively. These winds will transport the plume towards the coast and the Gulf of Saint Lawrence. The highest winds during winter are from the WNW with mean wind speeds in the range 19.3 to 20 km/h.

4.4.3.1 Frequency of Wind Speeds by Direction and Duration of Light Winds

The dispersion of pollutants is limited under light wind conditions. Generally, light winds (calms and winds <8 km/h) can lead to high ground level pollutant concentrations, especially during unstable atmospheric conditions. Such conditions are most likely in the summer. Table 4-11 shows the percentage frequency of wind speed classes by wind direction for the 10 year period 1979 to 1988. Calm periods occur about 11 percent of the time and wind speeds of 0 to 3 knots (0 to 5.5 km/h) occur 22% of the time. The average numbers of occurrences per year for specific durations of calms and for winds <8 km/h (not including calms) and for >40, >60 and >120 km/h for Chatham Airport are listed in Table 4-12. For example, a calm period persisting for 5 to 6 hours can be expected to occur an average of 16.9 times per year. Detailed analysis of the monthly data show that the light winds and calms occur more during the winter than for the other seasons because of the more frequent occurrences of <8 km/h winds for longer durations.

TABLE 4-9

Mean Wind Speed in Kilometres per Hour
Chatham Airport, 1951 - 1980[1]

DIRECTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
	MEAN WIND SPEED IN KM/H												
N	16.3	15.3	16.7	15.4	13.8	13.6	13.0	13.2	13.6	14.9	15.1	16.5	14.8
NNE	19.0	19.1	19.9	17.0	14.7	15.0	13.5	13.9	14.0	15.0	17.4	17.8	16.4
NE	19.7	19.3	19.7	18.1	15.4	15.4	13.5	13.9	14.2	14.4	16.2	17.9	16.5
ENE	17.7	16.9	18.8	17.5	16.3	15.8	13.4	14.6	14.2	14.7	16.9	17.2	16.2
E	13.9	13.4	14.5	13.2	12.9	12.6	10.6	10.3	11.7	12.1	12.1	14.9	12.7
ESE	13.2	11.7	13.7	12.7	12.7	13.1	11.0	10.5	10.8	11.5	12.9	17.4	12.6
SE	13.1	11.1	12.7	12.5	12.7	11.8	11.0	10.6	12.3	12.4	12.3	14.6	12.3
SSE	13.8	13.4	13.7	13.6	13.6	12.8	12.0	10.3	12.7	15.0	14.5	13.8	13.3
S	13.2	14.7	16.0	16.2	15.5	15.7	14.4	12.8	14.0	14.8	14.5	12.8	14.6
SSW	14.5	15.2	17.0	18.0	18.3	18.6	16.8	14.8	16.7	15.9	15.5	15.4	16.4
SW	14.5	16.3	16.4	16.3	17.1	16.5	15.0	14.3	15.8	15.7	15.1	15.1	15.7
WSW	15.9	17.0	17.6	15.6	16.8	15.5	14.2	13.7	14.3	15.2	15.6	15.9	15.6
W	17.7	16.8	18.3	16.5	16.5	14.6	14.0	14.4	14.3	15.9	16.3	17.2	16.0
WNW	19.4	20.0	21.2	19.1	18.5	18.2	16.5	16.2	17.2	19.4	19.6	19.3	18.7
NW	18.2	19.0	19.3	17.4	18.4	16.9	15.3	15.5	16.4	18.0	18.1	18.6	17.6
NNW	16.6	17.1	18.0	15.9	17.7	15.1	13.9	14.5	15.3	15.6	16.1	16.9	16.1
All Directions	15.4	15.7	16.6	15.3	14.9	14.6	13.3	12.7	13.7	14.4	14.7	15.2	14.7
Maximum Hourly Speed	72 NE	89 SVL	72 SVL	72 NE	77 SSW	74 SSW	64 SSW	53 SSW	89 S	64 SVL	72 SSW	77 SSE	89 SVL
Maximum Gust Speed	105 SSW	106 S	113 ENE	103 NE	129 S	116 WSW	89 NW	97 WNW	135 S	105 SVL	121 SSW	143 SSW	143 SSW

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[1] Atmospheric Environment Service, 1984.

TABLE 4-10

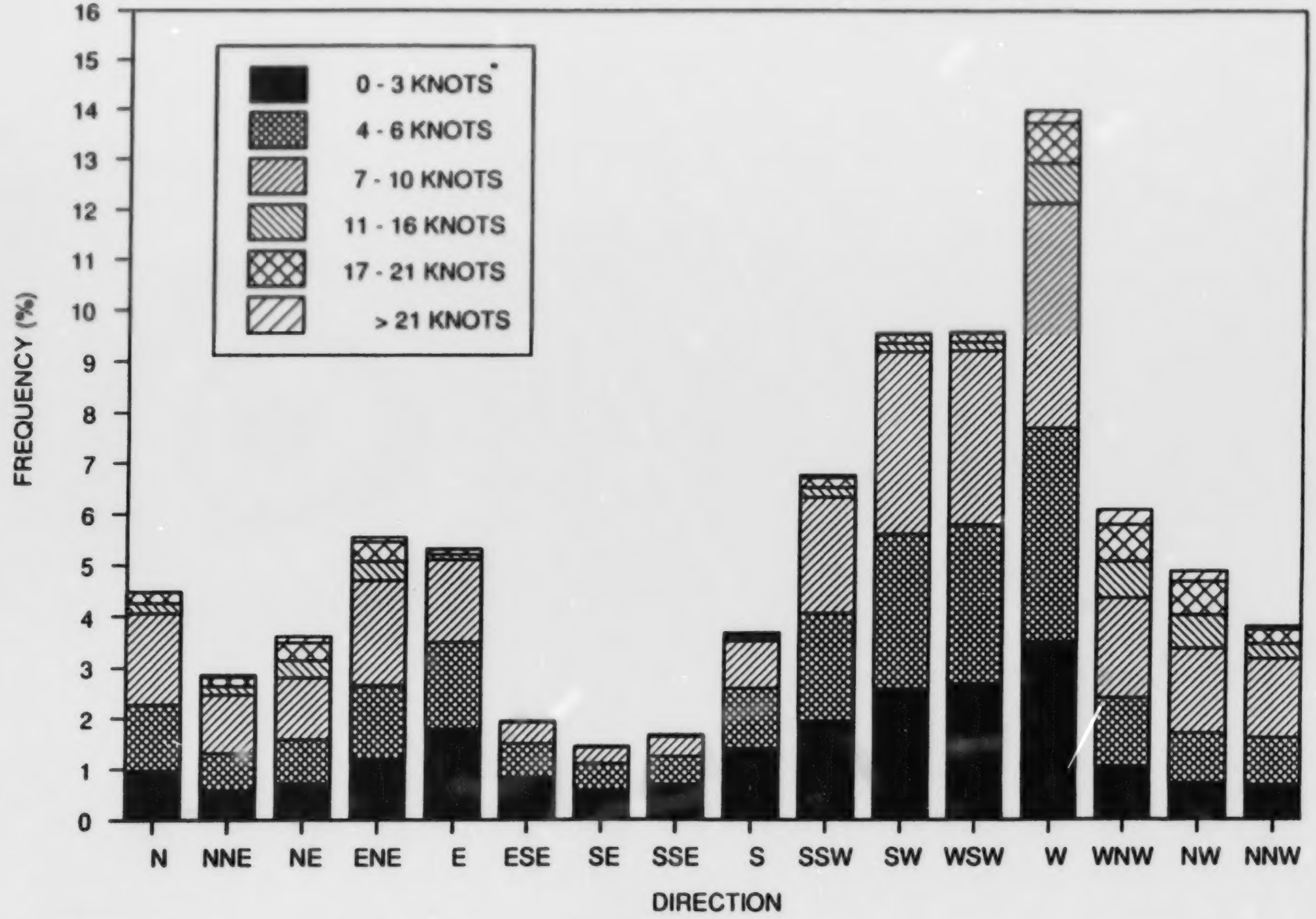
Percentage Frequency of Wind Direction
Chatham Airport, 1951 - 1980[1]

DIRECTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
	PERCENTAGE FREQUENCY												
N	5.2	4.6	6.2	5.6	5.0	3.4	3.2	3.4	4.2	4.6	5.3	5.9	4.7
NNE	3.5	3.9	5.5	5.5	4.7	3.7	2.2	2.6	3.0	3.5	4.2	3.5	3.8
NE	5.4	6.4	7.7	9.6	8.7	6.6	3.8	3.3	3.5	3.6	4.7	3.2	5.5
ENE	3.7	4.9	7.0	8.6	8.9	6.9	3.7	3.2	3.3	3.2	3.3	2.9	5.0
E	2.1	3.0	4.0	5.5	5.3	4.9	3.3	3.2	2.8	2.5	2.7	2.0	3.4
ESE	0.9	0.9	1.2	1.7	2.0	2.0	1.6	1.3	1.1	1.0	1.3	1.2	1.4
SE	1.2	1.0	1.1	1.5	1.9	2.1	1.9	1.6	1.4	1.4	1.4	1.2	1.5
SSE	1.2	1.2	1.2	1.6	1.8	1.5	2.0	1.7	1.4	1.7	1.8	1.3	1.5
S	3.0	3.6	3.4	4.0	5.3	6	8.5	6.5	6.6	5.2	5.0	3.5	5.1
SSW	4.7	3.7	4.5	5.3	7.6	12.8	13.8	12.5	10.8	8.8	6.7	5.4	8.1
SW	9.9	8.7	6.6	7.5	10.0	15.4	17.2	16.4	14.8	14.5	10.8	11.1	11.9
WSW	13.2	13.2	8.5	7.4	7.9	9.1	10.7	11.5	11.4	12.3	12.2	13.5	10.9
W	14.6	14.0	11.2	9.2	8.1	7.1	9.2	11.5	10.9	11.7	12.7	14.4	11.2
WNW	9.8	9.8	9.4	6.9	5.1	3.9	4.4	4.8	6.7	6.5	8.2	9.5	7.1
NW	7.4	7.7	8.1	7.1	5.4	3.8	3.7	4.4	5.5	6.3	6.5	7.4	6.1
NNW	5.6	4.9	5.9	5.7	4.2	3.1	2.4	3.2	4.2	4.9	4.6	5.3	4.5
CALM	8.6	8.5	8.5	7.3	8.1	7.6	8.4	8.9	8.4	8.3	8.6	8.7	8.3

[1] Atmospheric Environment Service, 1984.

FIGURE 4-8

Percentage Frequecy of Wind Speed By Wind Direction, Chatham Airport, 1979 - 1988[1]



[1] Based on data from Atmospheric Environment Service, 1984

* 1 knot = 1.85 km/h

TABLE 4-11

Percentage Frequency Of Wind Speed Classes By Wind Direction
Chatham Airport, 1979 to 1988

	SPEED RANGES IN KNOTS[1]						
	PERCENTAGE FREQUENCY						
DIRECTION	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	1.00	1.29	1.79	1.02	0.21	0.02	5.32
NNE	0.60	0.73	1.15	0.83	0.17	0.04	3.52
NE	0.74	0.87	1.21	1.18	0.34	0.14	4.48
ENE	1.22	1.45	2.05	1.67	0.38	0.10	6.87
E	1.81	1.70	1.61	0.73	0.10	0.02	5.97
ESE	0.85	0.67	0.42	0.12	0.01	0.00	2.08
SE	0.60	0.54	0.31	0.12	0.01	0.00	1.56
SSE	0.71	0.56	0.38	0.12	0.01	0.00	1.79
S	1.43	1.19	0.93	0.39	0.07	0.01	4.01
SSW	1.96	2.12	2.27	1.25	0.19	0.06	7.85
SW	2.60	3.04	3.57	1.69	0.17	0.02	11.09
WSW	2.71	3.11	3.42	1.61	0.17	0.02	11.04
W	3.52	4.21	4.41	2.77	0.81	0.25	15.96
WNW	1.07	1.34	1.97	2.08	0.72	0.29	7.48
NW	0.74	0.99	1.68	1.88	0.65	0.20	6.14
NNW	0.70	0.93	1.56	1.28	0.29	0.06	4.83
TOTAL	22.26	24.72	28.74	18.74	4.31	1.24	100.00

Total number of observations 87600
Total number of calms 9834 (11.2%)
[1] 1 knot = 1.85 km/h

TABLE 4-12

Average Number of Occurrences/Year of Wind Speeds For Various Durations*
Chatham Airport, 1951 - 1980[1]

Wind Speed (km/h)	Duration in hours								
	1	2	3	4	5-6	7-9	10-12	13-18	19-24
calm	177.9	64.7	31.4	18.6	16.9	10.7	3.6	0.8	0.1
< 8	418.2	151	64.6	29.6	23.2	8.6	2.3	0.8	0
> 40	28.8	7.8	3.6	1.9	1.9	1.8	0.3	0.2	0
> 60	1.8	0.4	0.1	0	0	0	0	0	0
> 120	0	0	0	0	0	0	0	0	0

* Statistics refer to the average number of occurrences per year for the specified condition, based on 35 years data. Events are mutually exclusive; that is, an occurrence in one duration class precludes its occurrence with another. Winds less than 8 km/h do not include calm winds.

[1] Atmospheric Environment Service, 1984

4.4.3.2 Precipitation Versus Wind Direction

Precipitation can scavenge air pollutants out of the atmosphere and result in acidic deposition. Table 4-13 displays the percentages of annual precipitation amounts associated with each wind direction from the long term Chatham data (1951 to 1980). The precipitation amounts are based on hourly observations. These data show that winds from the NE are associated with the highest amount (23 percent) of precipitation.

The majority (approximately 42 percent) of the precipitation is associated with NE and N winds.

Onshore winds (NE through SE) are associated with about 50 percent of the precipitation. It should be noted that the prevailing winds (from the SW) are associated with 26 percent of periods with no precipitation.

4.4.4 Humidity, Pressure and Sunshine

Climate normal data for these parameters are included in Table 4-7. The annual mean relative humidity is 76 percent and monthly mean relative humidity ranges from 71 to 81 percent. Barometric pressure has a mean of 101.3 kPa and a range of 101.2 to 101.5 kPa. Sunshine is highest in August when the percent of possible sunshine is 53.9 percent. The percent of possible sunshine is the percentage ratio of observed duration of sunshine to the duration that would be observed if terrain was level, no obstructions existed and the sky were clear.

4.4.5 Fog

Information on the occurrence of fog at Chatham Airport is included in Table 4-8 which lists the mean number of days with fog in each month. Fog is least likely to occur during the winter months of December through February and fog is most likely to occur during

TABLE 4-13

Percentage Frequency Of Precipitation Observations By Wind Direction Chatham Airport, 1951 - 1980[1]

Direction	Total Precipitation (%)	No Precipitation (%)	Total Observations		Total
			Precipitation	Absence	
Calm	5.98	8.39	3146	17085	20231
N	18.79	5.99	9884	12198	22082
NE	23.28	7.83	12245	15942	28187
E	8.45	3.93	4445	7995	12440
SE	5.44	2.48	2864	5056	7920
S	11.93	13.35	6278	27177	33455
SW	8.98	26.33	4723	53609	58332
W	7.65	20.77	4027	42302	46329
NW	9.50	10.93	4998	22263	27261
Total observations	100	100	52610	203627	256237

[1] Based on data from Atmospheric Environment Service, 1984.

July. Radiation fog is also likely to occur during the summer and early fall (indicated by the dominance of calm conditions for reduced visibility observations). It is expected that fog is most commonly associated with onshore easterly winds.

4.5 Air Pollution Meteorology for the Region

The air pollution potential is defined as the meteorological conditions which, given the existence of emissions, would be conducive to poor air quality. Conditions which allow for the accumulation of pollutants denote high air pollution potential. Parameters from which the dispersion of pollutants may be evaluated include the duration of light wind speeds, atmospheric stability and mixing heights.

4.5.1 Atmospheric Stability

The stability of the atmosphere is defined as its tendency to resist or enhance vertical motion. Three states of atmospheric stability are distinguished: unstable, neutral and stable, depending on the vertical temperature profile or lapse rate. Vertical dispersion of pollutants is greatest under unstable atmospheric conditions when the temperature decrease with height is greater than the adiabatic lapse rate of 0.98°C/100 m. An air parcel which is forced to rise in an unstable atmosphere will cool adiabatically and hence remain warmer than the surrounding air and continue to rise.

In a neutral atmosphere, the temperature lapse rate is equal to the adiabatic lapse rate of 0.98°C/100 m. A rising air parcel in a neutral atmosphere will remain at the same level once the force causing the rise has been removed. Horizontal dispersion will dominate over vertical dispersion under neutral conditions.

Vertical dispersion of pollutants is least effective in a stable atmosphere when the temperature lapse rate is less than the adiabatic lapse rate of 0.98°C/100 m. An air parcel forced to rise under such conditions will become cooler than the surrounding air and hence tends to sink back down to its original level once the force causing it to rise has been removed. Light winds frequently accompany stable conditions reducing horizontal dispersion, and further increasing the air pollution potential.

An elevated temperature inversion (increase in temperature with height) forms above a neutral or unstable boundary layer. The base of the inversion effectively forms a lid restricting dispersion. Pollutants can build-up in the boundary layer if there is a strong inversion and the plume is contained beneath the inversion base. Surface based inversions are most common during the early morning hours following radiative cooling of the earth's surface during clear nights.

One method for obtaining an estimate of atmospheric stability using data routinely observed at weather offices (wind speed and a net radiation index) is the STAR (STability ARray) analysis. Six stability classes are defined according to the scheme developed by Pasquill (1961). The definitions of these stability classes (A-F) are shown in Table 4-14. This method has been found to perform well in predicting plume-level stabilities. Stability analyses were performed for Chatham Airport using the STAR software program available through the Canadian Climate Centre (AES) and also using a meteorological preprocessor program which is an integral part of the short term dispersion modelling system used in this study. The seasonal and annual distributions of stability classes for Chatham Airport for the 10-year period 1979-1988 are given in Table 4-15. The distribution of the stability classes in the STAR analysis is considered biased towards the neutral class. STAR predictions of neutral stability are therefore higher (at the expense of the unstable and neutral classes) than those predicted by the meteorological preprocessor. The neutral D-class predominates throughout the year. As would be expected, unstable conditions (A,B,C) are most likely to occur during the summer (unstable =10.88% and A, B and C classes = 6.28%). Stable conditions (E and F) show a slight bias towards the winter and fall months.

TABLE 4-14

Meteorological Conditions Associated With Atmospheric Stability Classes

Surface Wind Speed (m/s)	Daytime Insolation			Nighttime Conditions	
	Strong	Moderate	Slight	Thin Overcast or 4/8 Cloudiness	3/8 Cloudiness
<2	A	A-B	B		
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

A. Extremely unstable conditions
B. Moderately unstable conditions
C. Slightly unstable conditions
D. Neutral conditions
E. Slightly stable conditions
F. Moderately stable conditions

TABLE 4-15

Seasonal and Annual Stability Classes Derived From STAR Analysis and From Meteorological Preprocessor Chatham Airport Data, 1979 - 1988

STAR Stability Classes

Frequency Distribution

Percent for Chatham Airport, 1979-1988

Stability	Winter	Spring	Summer	Fall	Annual
	(DJF)	(MAM)	(JJA)	(SON)	
A	0.00	0.15	0.34	0.04	0.53
B	0.33	1.03	1.96	0.67	3.99
C	1.42	2.16	3.98	2.04	9.60
D	15.19	15.82	11.52	13.76	56.29
E	3.16	2.24	2.46	3.19	11.05
F	4.91	3.59	4.73	5.31	18.54

Meteorological Preprocessor Stability Classes

Frequency Distribution

Percent for Chatham Airport, 1979-1988

Stability	Winter	Spring	Summer	Fall	AnnualrF
	(DJF)	(MAM)	(JJA)	(SON)	
UNSTABLE	0.08	7.43	10.88	3.67	22.06
NEUTRAL	11.14	11.17		7.75	10.9541.
STABLE	13.52	6.57	6.56	10.28	36.93

4.5.2 Mixing Heights

The mixing height is a parameter used to define the effective depth of the atmosphere (measured from the surface) through which the dispersion of pollutants can take place. Heat transferred to the atmosphere at the earth's surface results in convection and vertical mixing. The parameter used most often when considering air pollution potential is the maximum afternoon mixing height.

Analyses of Canadian and northern United States upper air station data have been prepared by Portelli (1977). The nearest stations to Millbank for which mixing height data are available are at Caribou, Maine, approximately 200 km to the west, and at Sept Iles, Quebec, approximately 370 km to the north. Sept Iles is in a coastal location while Caribou is further inland and thus is not influenced by the maritime climate. The better estimate of mean maximum afternoon mixing heights at Millbank would be expected to be closer to those measured at Sept Iles. The monthly values of mean maximum afternoon mixing heights for the two stations are displayed in Table 4-16. This table also contains predictions of the mean maximum afternoon mixing height calculated by the Ontario Regulation 308 (Environment Ontario, 1987) meteorological preprocessor. There is better agreement between the Regulation 308 predictions and the data from Sept Iles.

The use of mean maximum afternoon mixing height data for coastal locations can be misleading due to the differences which can occur between onshore and offshore flow. Maximum mixing heights for onshore flow will usually be highest in winter (sea warmer than land) and lowest in the summer (sea colder than land). The reverse is true for offshore flow. Given the location of the plant, only winds from the east can be considered as truly onshore. However, sea breeze effects so far inland (> 15 km from open sea) are considered unimportant. During the months of January through March, snow cover on land will negate the effect of onshore flow on mean mixing height values. For the remainder of the year, maximum mixing height values for onshore (east) winds would be much lower than indicated by the mean values. More detailed data available in Portelli

TABLE 4-16

Comparison Between Seasonal Mean Maximum Afternoon Mixing Heights at Chatham, N.B.; Sept Iles, Quebec; and Caribou, Maine

Source	Station	Winter	Spring	Summer	Fall
Reg. 308	Chatham, N.B.	477	858	774	625
Portelli	Caribou, Maine	576	1284	1431	907
Portelli	Sept Iles, Quebec	523	893	844	683

Source: Environment Ontario, 1987
Portelli, 1981, 1977

(1981) for Sept Iles show that for the summer months (June, July, August), for onshore flow (wind directions 90° to 200°), 56 percent of mean maximum mixing height values were below 400 m and 84 percent below 600 m compared to a mean value of 844 m for all wind directions. Predictions of the median mixing height for each hour of the day by season are listed in Table 4-17. As can be expected, the median mixing heights show a diurnal pattern in which the mixing height is highest in the afternoon as a result of solar heating. This influence is greatest in the summer.

4.5.3 Sources of Atmospheric Emissions in the Millbank Airshed

The existing sources (and their emission rates for SO_2, NO_2 and TSP) in the Millbank airshed are summarized in Table 4-18. The emissions from these sources are relatively small when compared with the total Provincial Emissions. The largest sources of SO_2, NO_2 and TSP are respectively from the Miramichi Pulp and Paper Package boiler (1400 t/y of SO_2), the NB Power Chatham TGS (50 t/y of NO_2) and the #4 Power Boiler at Miramichi Pulp and Paper (218 t/y of TSP). The emissions from these sources are to be compared with emissions from the proposed Millbank TGS of 628 t/y SO_2, 314 t/y NO_2 and 105 t/y of TSP, which are presented in Table 4-18 also.

4.5.4 SO_4 Deposition Measurements

Historical ambient air quality or wet deposition data in the vicinity of the proposed Millbank site are unavailable. Wet deposition monitoring of regional deposition levels at nearby sites in New Brunswick may be used to provide an indication of the existing background levels of wet sulphate deposition. Recent wet deposition monitoring data from the nearest stations namely, Trout Brook 25 km to the north west, and at Harcourt 68 km to the south southeast, are summarized in Table 4-19.

These annual wet deposition levels are in the range 9.9 to 15.2 kg SO_4/ha/y. A level of appropriate level for describing the existing background wet deposition level (Washburn

TABLE 4-17

Hourly Median Mixing Heights (m) Predicted[1] for Chatham Airport

Season	Hour																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Winter	237	237	227	237	232	237	227	227	227	237	34	37	441	441	47	477	44	370	341	23	237
Spring	302	302	302	302	237	341	398	386	342	390	1	0	548	592	7	738	1	858	852	7	341
Summer	204	173	173	173	173	341	341	243	304	349	43	48	532	578	65	682	79	733	774	62	204
Fall	227	204	204	227	204	227	227	341	316	323	0	7	441	477	7	551	7	481	341	5	237
											41	46			63		70			62	
											0	2			6		8			5	
											38	44			51		62			23	
											9	1			1		5			7	

[1] Predictions based on the Reg. 308 meteorological preprocessor.

TABLE 4-18
Summary of Sources in the Millbank Airshed

Source	Annual Emission Rates		
	SO_2	NO_2	Particulates
Proposed Millbank TGS (Based on 500 h/y)	628 t/y	314 t/y	105 t/y
Chatham TGS unit #3	500 t/y	50 t/y	50 t/y
MPPI [1] #1 Power Boiler	300 t/y	0	189 t/y[2]
MPPI Package Boiler	1400 t/y	0	0
Hog Fuel Boiler	105 t/y	0	11 t/y[2]
Flash Dryer cyclones	215 t/y	0	0
MPPI #4 Power Boiler	0	0	218 t/y[3]
MPPI #1 Lime Kiln	71 t/y[3]	0	71 t/y[3]
MPPI #2 Lime Kiln	6 t/y[3]	0	57 t/y
New Brunswick[4]	137,711 t/y[4]	46,287	94,310

[1] MPPI Miramichi Pulp and Paper Inc.

[2] Calculated based on g/s emission rates but corrected by the capacity factor derived from SO_2 information provided by N.B. Department of Environment

[3] Calculated based on the g/s emission rates with 100% capacity factor.

[4] Yandle, 1989

TABLE 4-19

Annual Wet Excess Sulphate Deposition Data in New Brunswick[1]

Station	Annual Excess Wet Sulphate Deposition kg SO_4/ha/y			
	1985	1986	1987	1988
Trout Brook[1]				13.9
Harcourt[1]				14.4
Harcourt[2]	9.8	16.5	9.7	15.2[3]
Harcourt[4]	11.0	14.2	14.3	

[1] Data from the NB Expanded Precipitation Monitoring network, May, 1988 to April, 1989 (Liston, 1989)

[2] Data from the CAPMoN Network (Vet et al., 1986, 1988, 1988a, 1989)

[3] Sukloff, 1990.

[4] Data from the NB Provincial Monitoring network.

and Gillis et al., 1989). A background level of 12.9 kg SO_4/ha/y will be used in connection with long term wet deposition modelling studies.

4.6 Noise

4.6.1 Noise - Definition and Measurement

Noise can be defined as "unwanted" sound or as a level of sound which causes annoyance to the recipient. The levels of noise (and sound in general) can be measured both subjectively (i.e. loud, quiet, etc.) and quantitatively. Quantitative methods of measurement are necessary to enable a prediction of the effects of new sources of sound on an existing environment.

Sound is generated when a surface in contact with air or other elastic medium vibrates and causes a variation in the atmospheric pressure. The magnitude of this variation in pressure is known as sound pressure and the number of variations per second is known as the frequency of the sound. The decibel scale (dB) has been developed as a measure of the level of sound pressure caused by such vibrations. The scale extends from O dB, the threshold of human hearing, to beyond 120 dB, the threshold of discomfort to humans. Figure 4-9 provides an indication of the perception of sound to recipients at various decibel values. This figure can be used for reference to interpret the dB values provided in this report with respect to the proposed combustion turbine project.

Ideally, all sound pressure measurements should be reported with reference to the frequency of the particular sound. This is not practical since many frequencies may be associated with any single source of sound. Hence, the so-called "A" weighted decibel scale (dB(A)) has been developed and accepted by most regulatory agencies as a measure of the combined overall sound pressure which takes into account the manner in which the human ear hears. All measurements of sound in this report are in dB(A) units.

FIGURE 4-9

Common Noise Levels and Typical Reactions

Sound Source	Noise Level dB	Loudness	Typical Reaction
	135		Painfully loud
Military Jet	130	Sixty-four times as loud	Limit amplified speech
Jet takeoff at 200'	120	Thirty-two time as loud	
	110	Sixteen times as loud	Maximum vocal effort
Jet takeoff at 2000'	100	Eight times as loud	
Freight Train at 50'	95		
Heavy truck at 50' Bus city street	90	Four times as loud	Very annoying Hearing damage (8 hours)
	80	Twice as loud	Annoying
Heavy traffic at 50'	70	Base reference	Telephone Use difficult
Light car traffic at 50'	60	Half as loud	Intrusive
Noisy office	50	Quarter as loud	Speech interference
Public library	40	Eighth as loud	Quiet
Soft whisper at 15'	30	Sixteenth as loud	Very Quiet
	10	Sixty-fourth as loud	Just Audible
Threshold of hearing	0		

Note: The minimum difference in noise level that is noticeable to the human listener is 3 dB. A 10 dB increase in level appears to double the loudness while a 10 dB decrease halves the apparent loudness.

Source: Canada Mortgage and Housing Corporation, 1977. Rail and Road. Effects on Housing C.M.H.C. Publication NHA 5156, December.

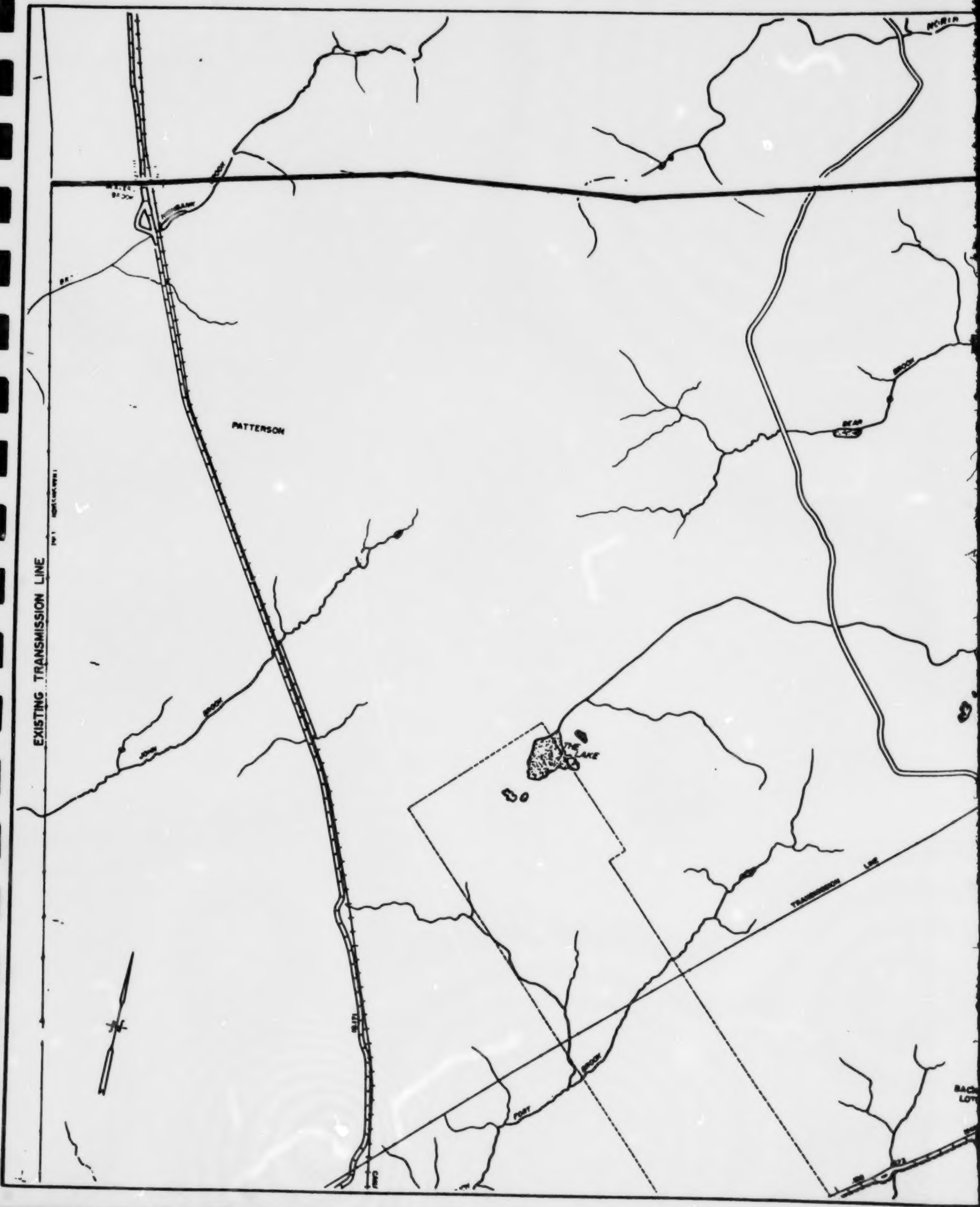
In general, an increase of 0 to 3 dB(A) above the ambient sound levels is usually not noticeable. A 4 to 5 dB(A) increase is generally considered to be a 'just noticeable' difference. Increase from 6 to 10 dB(A) are moderately significant to significant, while increases over 10 dB(A) are very significant and are likely to generate complaints.

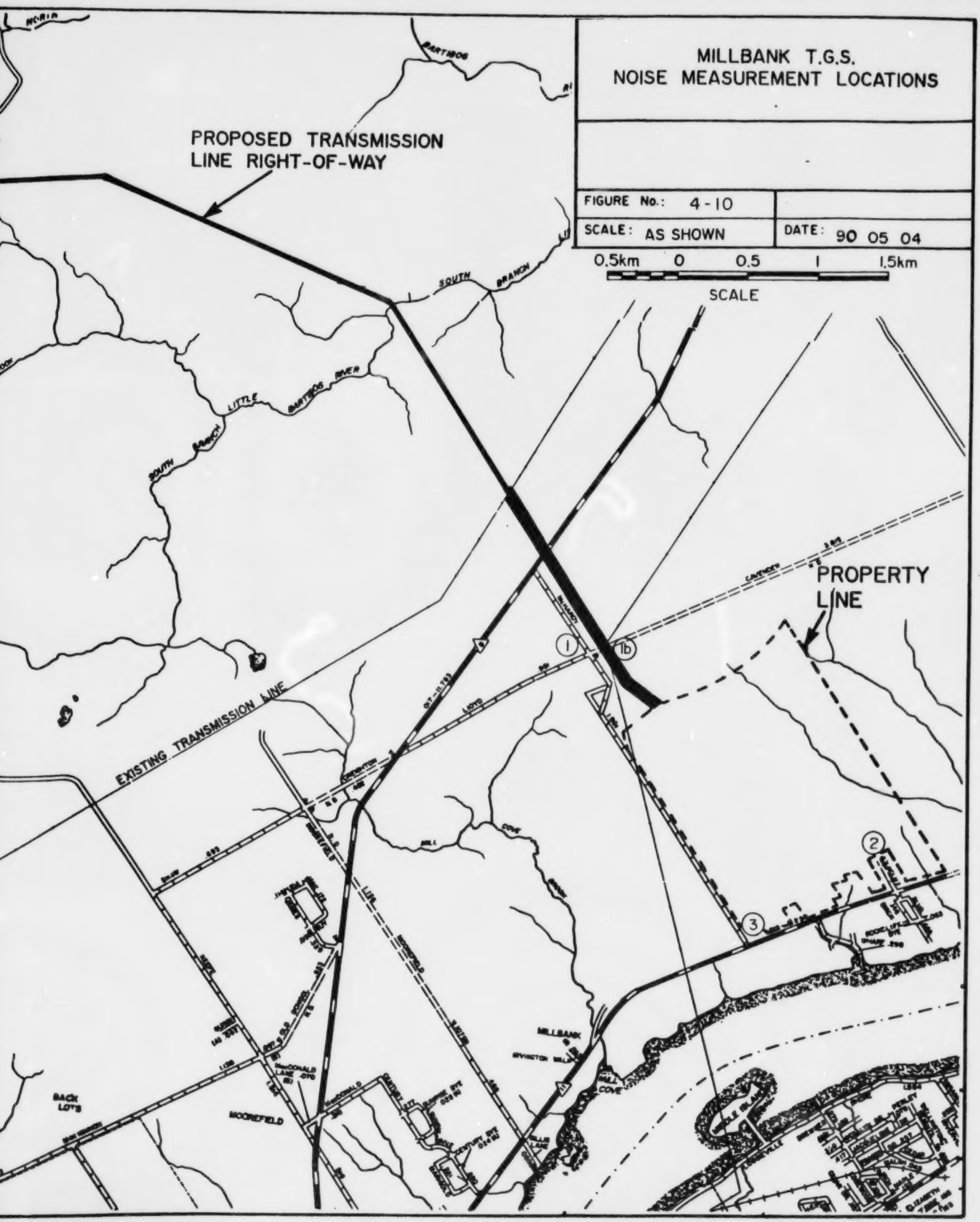
4.6.2 Pre-development Sound Levels

Pre-development sound levels were recorded at and near habitations in the Millbank area on March 12 and 13, 1990. The measurements were obtained during a period of favourable weather for sound measurements - low wind speeds, low humidity and at temperatures greater than 0°C. The measurements were obtained at three habitated areas nearest the proposed site, as shown in Figure 4-10. The results of the measurements with reference to the time-of-day, are given in Table 4-20.

The current levels of sound in the area are dominated by noise from traffic on Routes 8 and 11. The re-alignment of Route 8, to be completed by 1991, will increase the level of noise from this source at locations near the proposed plant site. Noise in the Millbank area also arises from distant rail traffic, distant industrial plants, barking dogs, wind, the Chatham air base, and vessel traffic in the Miramichi Channel.

In general, the current levels of sound in the area are typical of rural locations near highways. Areas remote from the highways are "quiet" whereas areas near the highways are characterized by at least occasional "intrusive" levels of noise.


EXISTING TRANSMISSION LINE
PATTERSON
JOHN
BROOK
THE LAKE
BEAR
BROOK
TRANSMISSION LINE
FORT
BROOK
BACK
LOT


PROPOSED TRANSMISSION LINE RIGHT-OF-WAY
PROPERTY LINE
EXISTING TRANSMISSION LINE
1
1b
2
3
SOUTH BRANCH
LITTLE BARTIBOG RIVER
SOUTH BRANCH
MILL COVE
MILLBANK
MOOREFIELD
BACK LOTS
0.5km 0 0.5 1 1.5km
SCALE

MILLBANK T.G.S.
NOISE MEASUREMENT LOCATIONS

FIGURE No.: 4-10	
SCALE: AS SHOWN	DATE: 90 05 04

TABLE 4-20

Pre-Development Sound Levels

March 13 and 14, 1990

Location[a]	Time Period			
	0700-1900	1900-2300	2300-0700	Max
1	33(30)	34(24)	33(23)	42
2	44(31)	37(25)	<30(21)	47
3	52(38)	48(27)	36(25)	55

[a] - refer to Figure 4-10 for sample location

Table reads as follows:

For data given as 33 - average dB(A) value

(30) - dB(A) is the value exceeded 90% of the time during measurement

Note: Measurements were made using a B & K2230 precision integrating sound level meter with a wind screen. Average dB(A) values are based on 20 minute measurement periods.

Max - maximum recorded value during the peak traffic periods (0700-0900 and 1530-1730)

CHAPTER FIVE

SOCIOECONOMIC SETTING

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5.1 Introduction

The proposed Millbank generating station is located within the area known locally as the "Miramichi". The Miramichi area was settled by the late 18th century, and by 1800, the communities of Chatham, Newcastle and Loggieville had developed. The first industries in the region were shipbuilding and lumber. The lumber industry originally developed to serve the shipbuilding industry. With the development of metal-hulled vessels, the lumber industry turned to new markets in pulpwood and plywood. Historically fishing and mining have also been important industries.

5.1.1 Study Area Boundaries

The study area boundaries were established on the basis of potential interaction between the project and the receiving economic and social environment. These interactions extend beyond the physical boundaries of the project site to include the local communities of Chatham and Newcastle as well as portions of Northumberland County. An area within a 50 kilometre radius of the site has been identified as a study area for describing the existing resources and also for determining the potential effects of atmospheric emissions on these resources.

5.2 Regional Overview

This section provides a profile of the social, economic and demographic characteristics of Northumberland County.

5.2.1 Population and Housing

The population of Northumberland County for 1981 and 1986 is indicated in Table 5-1. The population declined 2.1 percent from 54,134 in 1981 to 52,981 in 1986. During this period the population of the Province of New Brunswick grew 1.9 percent (Statistics Canada, 1986 and 1981). Northumberland County is relatively sparsely populated with a population density of 4.3 people per square kilometre compared to 9.9 per square kilometre for New Brunswick as a whole.

There are nine incorporated municipalities in the study area including two towns and seven villages. The population within these municipalities in 1986 was 20,256, accounting for approximately 38 percent of the total population. The incorporated communities had a population decrease of 5.0 percent while the unincorporated areas grew at 14.3 percent. The population of the Towns of Chatham and Newcastle declined by 542 people (8.0 percent) and 480 (7.6 percent) respectively over this period. The population of the parishes of Chatham and Newcastle both experienced population growth, 1.2 percent and 6.3 percent respectively.

There were 15,860 occupied private dwellings in 1986 in the study area, an increase of nine percent from 1981. The Towns of Chatham and Newcastle and the Parishes of Glenelg and Blackville had small decreases over this period. All other areas maintained or increased the number of occupied private dwellings as indicated on Table 5-2. The number of occupied private dwellings in unincorporated areas grew by 8.3 percent compared to an increase of 1.0 percent in the municipalities.

These figures demonstrate a trend towards increased suburban development common within New Brunswick. This trend implies a continued dispersion of the area's population into the rural portions of the county; some, undoubtedly, moving into the vicinity of the Millbank TGS.

TABLE 5-1

Northumberland County, Population, 1981 and 1986

	1981	1986	% Change
Northumberland County	54,134	52,981	-2.1
Incorporated Areas	21,324	20,256	-5.0
Blackville Village	892	903	1.2
Chatham Town	6761	6219	-8.0
Doaktown Village	1042	999	-4.1
Douglastown Village	1091	1133	3.8
Loggieville Village	810	764	-5.7
Neguac Village	1755	1754	-0.1
Nelson-Miramichi Village	1452	1407	-3.1
Newcastle Town	6284	5804	-7.6
Rogersville Village	1237	1273	2.9
Unincorporated Areas	26,984	30,864	14.3
Alnwick Parish	6716	6883	2.5
Big Hole Tract Reserve	48	52	8.3
Blackville	2468	2461	-0.3
Blissfield Parish	683	778	13.9
Burnt Church Reserve	637	+	
Chatham Parish	3732	3776	1.2
Derby Parish	1187	1168	-1.6
Eel Ground Reserve	293	328	11.9
Glenelg Parish	2055	1918	-6.7
Hardwicke Parish	2692	2755	2.3
Nelson Parish	1059	1086	2.5
Newcastle Parish	2929	3113	6.3
Northesk Parish	2880	2802	-2.7
Red Bank Reserve	206	264	28.2
Rogersville Parish	1463	1523	4.1
Southesk Parish	1924	1957	1.7

+Data not available
Source: Statistics Canada, 1981 and 1986

TABLE 5-2

Northumberland County, Occupied Private Dwellings

	1981	1986
Northumberland County	15,180	15,860
Incorporated Areas	6395	6460
Blackville Village	285	285
Chatham Town	1980	1925
Doaktown Village	340	350
Douglastown Village	315	345
Loggieville Village	220	245
Neguac Village	455	490
Nelson-Miramichi Village	380	385
Newcastle Town	2050	2010
Rogersville Village	370	425
Unincorporated Areas	8101	8775
Alnwick Parish	1603	1815
Big Hole Tract Reserve	15	20
Blackville Parish	645	700
Blissfield Parish	225	260
Chatham Parish	985	1035
Derby Parish	330	340
Eel Ground	80	90
Glenelg Parish	555	545
Hardwicke Parish	716	790
Nelson Parish	295	305
Newcastle Parish	835	925
Northesk Parish	825	845
Red Bank	50	60
Rogersville Parish	375	455
Southesk	540	590

Source: Statistics Canada, 1981, 1986

5.2.2 Employment and Income

5.2.2.1 Employment

During the 1971 to 1986 period, the total labour force in Northumberland County increased 40 percent. The number of females in the labour force increased by 57.2 percent while the number of males decreased by 15.1 percent during the period. The population growth of Northumberland County for this period was only 2.7 percent. The growth in the labour force is due to the rise in the female participation rate (from 24.1 percent in 1971 to 42.7 percent in 1986). The male participation rate fluctuated slightly with a net decrease of 0.4 percent. Labour force characteristics for Northumberland County from 1971 to 1986 are shown in Table 5-3. The Northumberland County unemployment rate between 1971 and 1986 more than doubled for the total labour force. The growth in employment opportunities has been less than the overall increase in the labour force, during this period.

More recent employment and income data is available only by region. Northumberland County is in the Northeastern Region which also includes Glouchester and Kent Counties. In 1989 the region had an unemployment rate of 19 percent compared to 10.6 percent for the Province (Canada Employment Centre, pers. comm.). The unemployment rate for the region is lower than the 1986 rate for Northumberland County, but is still substantially higher than the Provincial rate. The local labour market information analyst with the Newcastle Canada Employment Centre has indicated that a "ballpark" estimate of the unemployment rate in the Chatham/Newcastle area would be approximately 10 percent (P. Richard, pers. comm.).

5.2.2.2 Income and Income Assistance

Income characteristics for Northumberland County compared to New Brunswick and Canada are shown in Table 5-4. Average family income is lower in Northumberland

TABLE 5-3

Northumberland County Labour Force Characterictics

	1971	1976	1981	1986
Labour Force				
Total	15,410	19,590	19,630	21,690
Male	11,385	12,035	12,735	9,620
Female	4,020	5,555	6,895	6,320
Participation Rate				
Total	46.6%	48.0%	58.1%	54.8%
Male	67.2%	64.5%	65.7%	66.8%
Female	24.1%	30.8%	35.7%	42.7%
Unemployment Rate				
Total	11.1%	14.6%	21.4%	26.5%
Male	11.5%	13.9%	22.3%	27.5%
Female	10.0%	16.1%	19.8%	24.8%

Source: Statistics Canada, 1971, 1976, 1981, 1986

TABLE 5-4

Income Characterictics 1985

	Average Family Income	Incidence of Low Income
Northumberland County	$26,566	20.8%
New Brunswick	$30,527	17.0%
Canada	$37,827	14.3%

Source: Statistics Canada, 1986

County than in New Brunswick or in Canada. Incidence of low income is defined by Statistics Canada as:

> the proportion or percentage of units in a given classification below the income cut-offs. Income status refers to the position of economic families and unattached individuals in relation to Statistics Canada's low income cut-offs. These cut-offs are determined separately for families of different sizes and living in areas of different degrees of urbanization.

The percentage of families and individuals below Statistics Canada's low income cut-offs is higher in Northumberland County than in the Province or in Canada.

Table 5-5 compares the average number of income assistance recipients for Northumberland County and New Brunswick for three fiscal years between 1981 and 1990. The number of recipients in Northumberland County has been greater than the average for the Province but has followed a similar trend. The Acting Director of Systems Services for the Department of Income Assistance has indicated that the drop in average monthly caseload and income assistance recipients between 1986-1987 and 1989-1990 is a short-term benefit brought about in part by Federal and Provincial employment enhancement programs, which include:

- skills development;

- employment placement; and

- temporary salary funding.

These programs are aimed at intercepting the welfare cycle syndrome. A slight improvement in the economy has also increased employment in the study area and in the Province (G. Baird, pers. comm.).

TABLE 5-5

Income Assistance

	Fiscal Year		
	1981-1982	1986-1987	1989-1990
Northumberland County*			
Aver. Monthly Case Load	2665	2990	2658
Aver. Monthly Recipients	5933	6493	5433
Percentage of Population	10%	12%	+
New Brunswick			
Aver. Monthly Case Load	31,143	35,653	34,155
Aver. Monthly Recipients	64,049	71,166	66,279
Percentage of Population	9.2%	10.3%	+

* Based on Newcastle and Neguac Offices which have jurisdiction over Northumberland County

+ Data not available

Source: G. Baird, pers. comm., 1990

5.2.3 Industrial Structure and Economic Base

Employment by Industrial Division for Northumberland County for 1981 and 1986 is shown on Table 5-6. There has been an increase in employment for all industries of 8.4 percent over 1981. Major increases for this period were in construction, transportation, communication and other utilities, public administration, and defense. The largest decrease in employment was the communication business and personal service industry. The construction industry has probably shown further employment increases since 1986 with a series of major development projects. The defense industry has decreased since 1986 with major cutbacks at CFB Chatham and the closing of CFS St. Margarets. The area's dependence on the primary sector has declined 5.6 percent to 14.9 percent; this is still higher than the Provincial level of 8 percent.

The pulp and paper industry is the largest employer in the area (Applied Management Consultants, 1988). Within the study area, approximately 30 percent of the total employment in the resource base (primary and manufacturing sectors) is related to the pulp and paper industry. The number employed in this sector has increased by 85.7 percent since 1982. Miramichi Pulp and Paper (Repap) is the largest employer in the study region and is currently undertaking a $1 billion expansion of its operation in Newcastle.

5.2.4 Community Services and Infrastructure

5.2.4.1 Police

The Towns of Chatham and Newcastle and the Village of Blackville have their own police departments. The Newcastle force is largest with 14 officers and four vehicles. The Chatham Police Department has 13 officers and three vehicles, and the Blackville Police Department has three officers and two vehicles. The rest of the study area is served by the RCMP through the detachment in Newcastle which is responsible for most of

TABLE 5-6

Employment Northumberland County by Industrial Division

	1981	1986	% change
All Industries	18,955	20,560	+8.4%
Primary Industry	2,835	2,675	-5.6%
Manufacturing	2,775	2,575	-3.0%
Construction	1,515	1,855	+22.4%
Transportation, communication & other utilities	915	1,270	+38.0%
Trade	3,155	3,175	+0.63%
Finance, insurance, real estate	450	475	+5.6%
Communication business, personal service indus.	4545	2,895	-36.3%
Public Admin. & Defense	2670	5,645	+111.4%

Source: Statistics Canada 1981,1986

Northumberland County. The Newcastle detachment is responsible for the largest area (in square kilometres) of any detachment in the Province.

5.2.4.2 Fire Protection

The Miramichi Valley Firefighters Association provides a central dispatch system for fire protection for all of Northumberland County with the exception of Chatham, Rogersville and Neguac which have their own dispatch services. The Association is a mutual aid organization made up of 40 volunteer and 10 permanent fire fighters from 16 fire departments in the Miramichi region. The fire departments at CFB Chatham and the industrial fire departments at the paper mills are part of the Association. The Association meets monthly except July and August and regularly holds "Hazmat" (hazardous materials) courses through the Department of Advanced Education and Training at the Community College. The Miramichi Valley Firefighters Association responded to 648 calls in 1989. According to the President of the Association, their equipment is generally adequate. The association has one boat. The President has indicated that the area is well served with fire protection and will continue to be if they are able to maintain adequate manpower (F. Young, pers. comm.).

Fire protection in the Chatham/Newcastle area is provided by the Chatham and Newcastle fire departments. These departments are made up of professional and volunteer firefighters. The Newcastle Fire Department has nine full-time and 32 volunteer firefighters with four trucks and one boat; the Chatham Fire Department is similar in size to Newcastle with six full-time and 30 volunteer firefighters, four trucks, a boat and a rescue unit.

5.2.4.3 Health Care Services

Health care services in the study area are provided by the Hotel Dieu Hospital in Chatham and the Miramichi Hospital in Newcastle. In addition, in-home care is available through the New Brunswick Extramural Hospital program.

The Miramichi Hospital in Newcastle offers both in-patient and out-patient services. The hospital employs 26 medical staff including an obstetrician/gynaecologist, an anaesthetist, two surgeons, a radiologist, 16 general practitioners and five dental practitioners. In addition there are six full-time nurses, three casual nurses and a hospital director. The Hotel Dieu Hospital in Chatham has 33 staff including an obstetrician/gynaecologist, three anaesthetists, two general surgeons, two radiologists, 11 general practitioners, an internist and a urologist, as well as nursing, administrative and support staff. A summary of the statistics for the two hospitals is provided in Table 5-7.

The Director of Hospital Services for the Province has indicated that the number of physicians in the Chatham/Newcastle area is typical of communities of comparable size elsewhere in the Province. The occupancy rate at the two area hospitals is lower than that in Saint John, Moncton or Fredericton therefore making some services more accessible than at the larger hospitals. The Province has initiated the Northern Service Development Program to improve health care in the northern part of the Province. The new services will be offered at the existing hospitals until the new hospital planned for the region is built (W. Waller, pers. comm.).

Ambulance Services

The Director of Ambulance Services for the Province of New Brunswick has indicated that emergency ambulance services in Newcastle are provided by the Miramichi Ambulance Service based at the Miramichi Hospital. The Miramichi Ambulance Service operates two vehicles. There is no charge to residents of Chatham and Newcastle for emergency

TABLE 5-7

Hospital Statistics, Northumberland County

	Miramichi (Newcastle)	Hotel Dieu Hospital (Chatham)
Approved Beds	104	125
Patient Days	26,538	31,496
Occupancy Rate	69.9	69.03
Average Length of Stay (days)	6.49	7.79
Average Number of Patients	86.29	72.71

Source: New Brunswick Department of Health and Community Services (1988) service. Invalid transport service is provided at no charge by the St. John Ambulance which operates one vehicle (C. McKay, pers. comm.).

Emergency ambulance service in Chatham is provided by the Chatham Area Ambulance Service which is based at the Hotel Dieu Hospital in Chatham. The services operates two vehicles and there is no charge for any services. The St. John Ambulance in Chatham provides invalid transport at no charge (C. McKay, pers. comm.).

5.2.4.4 Water and Sewer

In the unincorporated areas, individual residents are responsible for their own water and sewer service. Some municipalities provide piped water and sewer services to some or all residents of the municipality. Residential properties which are not serviced use private wells and on-site sewage disposal systems. Depending on the municipality, the charge for municipal water service may be based on a flat rate per year, by the amount used, or a combination of both. The operation and maintenance of water and sewer services is paid for by the municipalities through user fees and grants from the Provincial Government.

5.2.4.5 Education

Most of Northumberland County falls within the jurisdiction of School Districts 8, 9, and 10 for English-speaking students and District 53 for the French-speaking community. There were a total of 4,238 students and 876 teachers in School Districts 8, 9, and 10 during the 1989-1990 school year. School District 53 had a total of 306 students and 30 teachers during the 1998-1990 school year.

Table 5-8 shows the condition and enrollment capacity of schools in Chatham and Newcastle. The junior high school in Chatham is the only school that is at enrollment capacity. The School Board offices of Districts 8 and 10 have indicated that the other

TABLE 5-8

Chatham and Newcastle School Statistics 1989-1990

	Enrollment	Surplus Capacity	Physical Condition
Chatham			
Elementary	844	not full	good
Junior High	664	full	good
High School	866	not full	5 to 6 years old, good
Newcastle			
Elementary	734	near capacity	good
Junior High	661	near capacity	good
High School	869	131 students	good

Source: School Board Offices 8 and 10, pers. comm., 1990 schools could accommodate additional students (School Board Offices 8 and 10, pers. comm. 1990)

In addition to the public school system, the Miramichi Community College in Chatham offers a variety of commercial, industrial and specialized technical courses. The University of New Brunswick and Saint Thomas University, both based in Fredericton, offer extension courses in the Chatham/Newcastle area.

5.2.4.6 Communication

There are three weekly newspapers published in English in the study area. The Miramichi Weekend and the Northumberland News are published in Chatham, and the Miramichi Leader is published in Newcastle. In addition, daily newspapers such as the "Telegraph Journal" from Saint John, the Fredericton "Daily Gleaner" and the Moncton "Times-Transcript" are available in the area.

The major local radio station in the area is CFAN, an English AM station, in Chatham. In addition, the area receives AM and FM French and English radio stations from other areas of the Province.

5.2.5 Municipal Finances

The residential municipal tax rate for municipalities is collected by the Provincial government on behalf of the individual municipalities. The 1990 tax rate set by each municipality is shown in Table 5-9. Within the Local Service Districts (LSD), a basic provincial rate of $0.65 per $100 of assessed value is levied plus a supplementary rate for services such as fire protection, ambulance or street lighting where applicable. The supplementary rate varies from one LSD to another depending on the services provided. It will usually not exceed $0.50 per $100 of assessed value. The non-residential rate is 1.5 times the residential rate within the municipalities. The Towns of Chatham and

TABLE 5-9

1990 Municipal Taxes Northumberland County

Municipality/LSD	Municipal Tax Rate*	Tax Base ($)
Town of Newcastle	1.2048	375,933,450
Town of Chatham	1.2493	219,714,600
Village of Blackville	0.9182	23,546,500
Village of Doaktown	0.8812	18,466,900
Village of Loggieville	1.1437	12,142,950
Village of Douglastown	1.0490	51,140,450
Village of Rogersville	1.1422	26,988,950
Village of Nelson-Miramichi	0.9342	35,201,550
Alnwick LSD	0.1104	23,876,050
Barryville-Alnwick LSD	0.2999	1,516,300
Blackville LSD	0.0898	19,405,800
Blissville LSD	0.1015	11,727,150
Chatham LSD	0.0901	33,375,600
Derby LSD	0.0892	16,340,550
Ferry Road-Russellville	0.1276	24,583,850
Glenelg	0.0860	17,317,400
Hardwick LSD	0.0692	1,432,600
Nelson LSD	0.1361	11,357,800
Newcastle LSD	0.1045	11,806,300
Northesk LSD (Less Heath Steele)	0.1368	28,529,350
Northesk LSD (Heath Steel)	0.0468	10,046,550
Southesk LSD	0.1409	28,313,150
Rogersville LSD	0.0881	16,804,500
Tabusintac LSD	0.2839	13,295,300

* $ per $100 of Assessed Value

Source: New Brunswick Department of Municipal Affairs, pers. comm., 1990

Newcastle have the highest tax rates (1.2048 and 1.2493 respectively) and the largest tax bases in the county. The tax rates are higher in the municipalities than in the unincorporated areas. Communities with a higher tax base per capita are better able to provide community services and recreational facilities. The Millbank generating station site is located in the Ferry Road-Russellville local service district which has a municipal tax rate of $0.1276 (plus the Provincial rate of $.65 per $100 assessed value).

5.2.6 Transportation

The primary arterial and collector highways through Northumberland County are Routes 8, 11, 123 and 126. Route 8 is the most important highway in the area as it joins most of the communities located in the study area. In addition, Route 8 connects the area with Bathurst to the north and Fredericton to the south. Route 8 passes through Newcastle, Douglastown, Blackville, and Doaktown and intersects Route 11 at Chatham, Route 126 at Newcastle and Route 123 at Doaktown. Route 11 connects the Chatham/Newcastle area with Tracadie and the Acadian Peninsula. Route 123 joins the Chipman/Minto area to Doaktown to the north and intersects Route 116 at Chipman. Route 116 runs east-west between Chipman and Route 126. Route 126 passes through Rogersville, Nelson-Miramichi and Newcastle.

Within the incorporated municipalities, road maintenance is the responsibility of the municipality. Larger municipalities generally have their own municipal maintenance departments. Smaller municipalities contract road maintenance to private firms or have their streets maintained under contract with the Department of Transportation. The Department of Transportation is responsible for road maintenance in the unincorporated areas, including the stretch of Route 11 which borders the proposed generating station site in Millbank.

Air transportation is provided through the Miramichi Municipal Airport near CFB Chatham. Canadian Airlines International provides daily service to Fredericton with connections to Montreal and Halifax and non-stop service to Montreal on Sundays.

The main line of the Canadian National Railway between Halifax and Montreal passes through the region, with a station in Newcastle. Via Rail offers limited passenger service from Newcastle to Montreal and Halifax.

Bus service in the region is provided by SMT in the Miramichi area. SMT operates an inter-urban service throughout the Province. There is a terminal in Newcastle with agents in Chatham, Doaktown and Rogersville.

5.2.7 Planned Future Development

The Economic Development Officer of the Miramichi Region Development Corporation has indicated that three major economic development projects are planned for the area. Construction on a new shipbuilding museum and interpretive facility in Newcastle is expected to start in the summer of 1990. This $3.4 million facility is expected to be completed by March of 1992. A $9 million Irish Cultural Centre is planned for the Chatham area. Funds are currently being identified for this project. Construction of a $6.0 million retail/office complex in Newcastle began in the spring of 1990 (C. Mutch, pers. comm.). Other recent major investments in the region include:

- Alcell Plant (Repap) $65.0 M (completed);
- NB Power Plant - Chatham Industrial Park $2.5 M (completed);
- Douglas River Plaza - Douglastown (completed and filled);
- Second Coated Paper Machine (Repap) $500.0 M (completed);

- New Boiler/Kraft Plant (Repap) $6.5 M (ongoing);
- Renovations - Atlantic Waferboard $13.5 M (ongoing);
- New Brunswick Community College -Miramichi Expansion $5.5 M (ongoing);
- Retail/Office Complex - Chatham $5.5 M (complete), and
- Chatham Library $0.7 M (complete).

5.3 Regional Economic Prognosis

The following economic prognosis for the study area projects the anticipated economic climate without the development of a generating station at Millbank. The study area is within the jurisdiction of the Miramichi Region Development Corporation, ie. Northumberland County excluding Rogersville and Neguac. The boundaries of the study area were selected because of availability of relevant data and forecasts. Forestry related activities (pulp and paper, logging and harvesting, sawmills and wood products), mining, construction and tourism are major economic activities in the Miramichi area.

5.3.1 Forestry and Forest Products

5.3.2.1 Pulp and Paper

The pulp and paper industry is the largest employer in the Miramichi region and accounts for approximately 30 percent of the total employment in the region's resource base (primary and manufacturing sectors). Employment in the industry has increased 85.7 percent since 1982 (Applied Management Consultants, 1988).

The recent $480 million expansion at the Miramichi Pulp and Paper Ltd. (Repap) mill (part of a total capital investment by Repap of $1 billion) and the introduction of the new coated paper machines at Repap will create 200 new permanent jobs in the area. The international demand for coated paper is expected to grow and thus provide a secure market. The Government of Canada has invested $20 million in the $65 million experimental Alcell demonstration plant. This process uses alcohol and cellulose from hardwood to produce pulp, eliminating the use of sulphur and sodium-based chemicals, as well as chlorine in the bleaching process. The Alcell plant provides 50 new permanent jobs. If the process is commercially viable on a small-scale basis, it will be developed in other locations.

The strong demand for hardwood for the Alcell plant and the Repap A-1 coated paper operation has doubled the consumption of ground wood. This demand will stimulate the road construction industry and silviculture operations, providing an additional boost to the local economy.

The Manager of Repap has indicated that the next decade will be a period of oversupply of mature, low quality budworm damaged forest. A projected shortfall in wood supply in the Miramichi area is projected to occur in about twenty years. The current supply will have to be prolonged up to thirty years beyond its normal life span to prevent a shortfall of spruce and fir to supply the mills. The critical period will be around 2010. It will be almost impossible to avoid a five to seven year shortfall; the "present land base cannot be diminished for growing trees". It is expected that after 2020 it will be possible to expand the industry (H. O'Neill, pers. comm.).

The pulp and paper industry is therefore vulnerable and supply from private woodlots will become increasingly important.

5.3.2.2 Logging and Harvesting

Increased demand for hardwood and softwood has stimulated employment growth in this sector. This is offset somewhat by the increased mechanization of harvesting, lowering the demand for manual labour. There will be some increase in employment in forest management (i.e., silviculture activities) as supplies of particular types of wood decline (Applied Management Consultants 1988).

5.3.2.3 Sawmills and Wood Products

Employment at sawmills and other wood products facilities fell 19.3 percent between 1982 and 1988 according to the Miramichi Region Development Corporation. The Corporation predicts that there will be a serious sawlog supply problem within the next 5-10 years. A lack of veneer quality wood for the Burchill plant threatened closure for part of 1989. Unless alternative supplies are found, employment in this sector will continue to decline (C. Mutch, pers. comm.).

5.3.2 Mining

The 1989 reopening of the Heath Steele base metal mine generated employment for over 215 workers, and provided a major boost to the economy of the Miramichi area (C. Mutch, pers. comm.). According to the New Brunswick Statistics Agency (1989), the mineral reserves are expected to last at least five years and exploration, currently underway, will attempt to extend the life of the mine. Zinc prices are strong and are forecast to remain so as demand increases with constant supply. A proposed zinc smelter in Quebec could lead to the construction of a zinc pretreating plant in northern New Brunswick. A feasibility study for a $75 million plant will be completed soon.

5.3.3 Construction

In addition to the construction projects in the manufacturing sector, a major retail/office complex in downtown Chatham has recently been completed and construction on a $6 million retail/office complex in Newcastle will begin in the spring of 1990. Construction of a $3.4 million ship building museum and interpretive facility in Newcastle is expected to begin in the summer of 1990 (C. Mutch, pers. comm.).

5.3.4 Fishery and Fish Processing

According to the Department of Fisheries and Oceans there were 1151 licensed fishermen in 1987 in the three districts (70, 71, and 73) along the coast of Northumberland County. The major species harvested in the area are cod, white hake, herring, mackerel, smelt, clams, mussels, oysters, scallops and lobster.

Landed values of the total catch for 1985 to 1988 are indicated on Table 5-10. The total landed value for the three districts peaked in 1987 but generally increased over this period. Data from Fisheries and Oceans is not yet available for 1989 (G. Nowlin, pers. comm.). According to the Department of Economic Research, Toronto Dominion Bank, 1989 was a difficult year for the fishery with total landed values for the Province down by 20 per cent for the first nine months of the year. The drop in total landed value was caused by a decline in lobster prices and shortages in crab and groundfish (Toronto Dominion Bank, 1990). Lobster and crab are major species in the study area.

Problems are expected to continue in the crab fishery because of shortages in stocks. Lobster stocks are not a problem; price fluctuations will continue to determine the strength of this sector.

TABLE 5-10

Total Landed Value of Fish By District

	District 70	District 71	District 73	Total
1985	$2,115,795	$491,925	$2,374,422	$4,982,142
1986	$2,325,597	$371,585	$3,410,603	$6,107,785
1987	$3,855,740	$351,821	$4,785,001	$8,992,562
1988	$3,128,732	$256,264	$3,356,516	$6,741,512
1989	data not available			

Source: Fisheries and Oceans Canada, Unpublished Data 1986-1989, Current Dollars

5.4 Site Profile

5.4.1 General Location

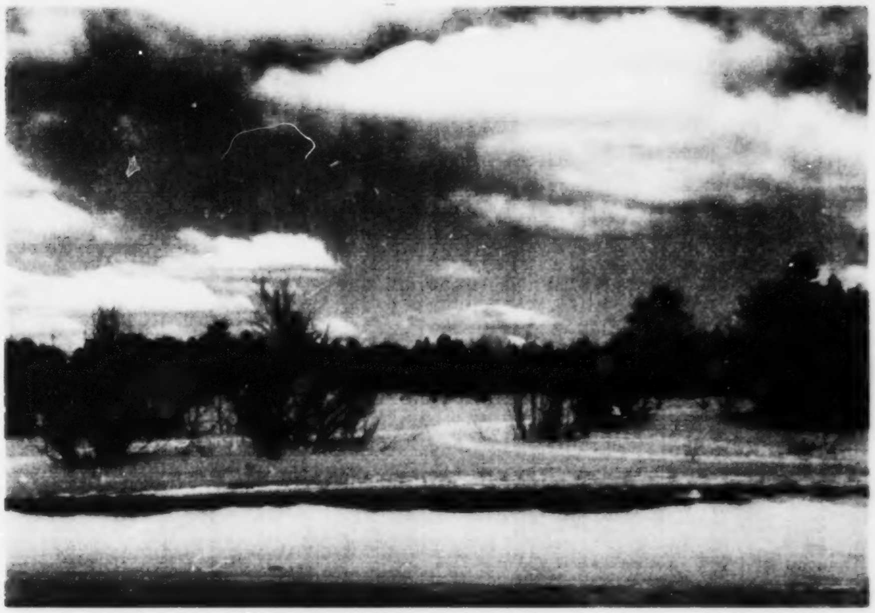
NB Power proposes to construct and operate a combustion turbine generating station at Millbank, New Brunswick. The proposed site is located on the McHardy Road north of the Miramichi River and northeast of Chatham and Newcastle. It is located approximately one kilometre north of the intersection of McHardy Road and Route 11. The site location is shown on Figure 3-6.

5.4.2 Existing Infrastructure

The proposed site is located within the jurisdiction of the Ferry Road-Russellville Local Service District (established in 1988). Municipal water and sewage services are not provided in the area; local residents have private wells and septic systems. According to the municipal services representative for the New Brunswick Department of Municipal Affairs, fire service for the Ferry Road-Russellville Local Service District is provided by the Douglastown fire department. Police service is provided by the RCMP detachment in Newcastle. Solid waste is taken by residents or by private contractor to the Chatham landfill site (D. Rae, pers. comm.). The site has access to electric power and telephone service from transmission lines along the McHardy Road.

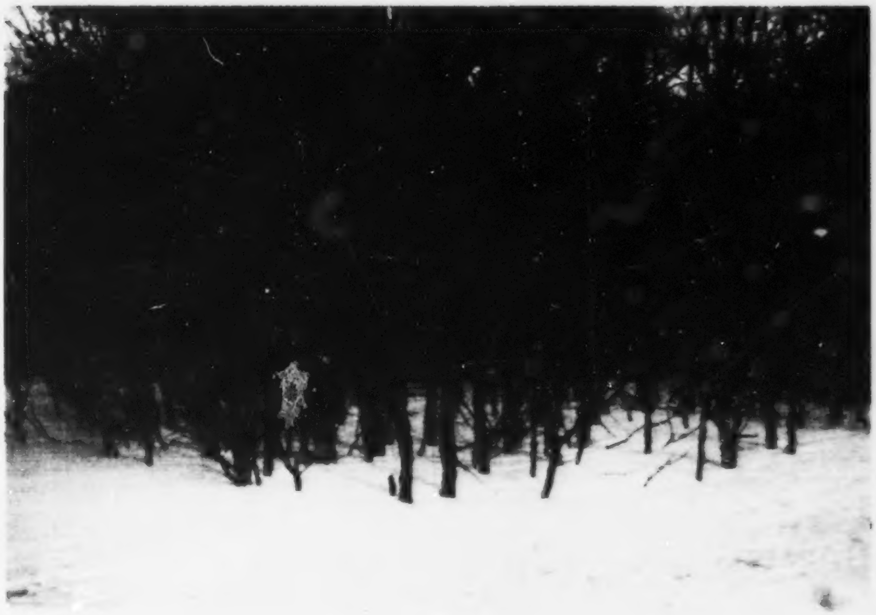
5.4.3 Land Use, Ownership and Control

The proposed site is currently undeveloped, with mixed hard and softwood cover. Local residents use the site property for picking wild berries, especially blueberries. They also cross-country ski, snowmobile and drive ATVs on the proposed site (C. Fracker, pers. comm.). Figures 5-1 and 5-2 show the site in its existing state. The proposed site covers approximately 269 hectares. The land is privately owned and NB Power has obtained options to buy the required area.



PROPOSED MILLBANK
T.G.S. SITE
EXISTING LAND USE

FIGURE 5-1



PROPOSED MILLBANK
T.G.S. SITE
EXISTING LAND USE

FIGURE 5-2

5.4.4 Land Use in Immediate Vicinity

Existing land use within one kilometre of the site along Route 11 consists primarily of single family dwellings, as well as cleared and forested undeveloped land. The Rockcliffe subdivision on the north side of Route 11 is surrounded on three sides by the proposed site and presently has six dwellings and five undeveloped lots; the part of the subdivision directly across Route 11 from the proposed site and presently has 15 dwellings and five undeveloped lots. Figure 5-3 shows the Rockcliffe subdivision on the north side of Route 11; Figure 5-4 shows the subdivision directly across Route 11. According to a local real estate agent, the area is expected to experience increased residential growth because of a paucity of suitable residential development land in the Chatham/Newcastle area (B. Burchill, pers. comm.).

Several small commercial establishments are located along Route 11 within one kilometre of the proposed site, including:

- Henderson's Lumber Co.;
- Blakeley Bros. Trucking, and
- Northside Auto Body.

Metro Marine Transport & Terminals Ltd. of Douglastown and Metro Fuel Company Ltd. of Moncton have property with fuel storage and distribution facilities located adjacent to the Department of Public Works wharf on the Miramichi River. These facilities, presently owned by Imperial Oil, are not currently operational. This area is also used for winter storage of boats and buoys which belong to Public Works Canada.

ROCKCLIFFE SUBDIVISION
NORTH SIDE OF ROUTE 11
FIGURE 5-3

ROCKCLIFFE SUBDIVISION
SOUTH SIDE OF ROUTE 11
FIGURE 5-4

A Christmas tree plantation located southwest of the proposed site approximately 700 metres along Route 11 is illustrated in Figures 5-5 and 5-6. According to the owner of the plantation, 34,000 trees were planted with additional trees from natural regeneration along the McHardy Road. The species grown are balsam fir and scotch pine. Harvesting began in 1989 and will continue for a ten year period with 1000 to 2000 trees to be sold each year (R. Murdock, pers. comm.). A smaller plantation of balsam fir trees is located to the southeast of the site. Both plantations are shown on Figure 5-7.

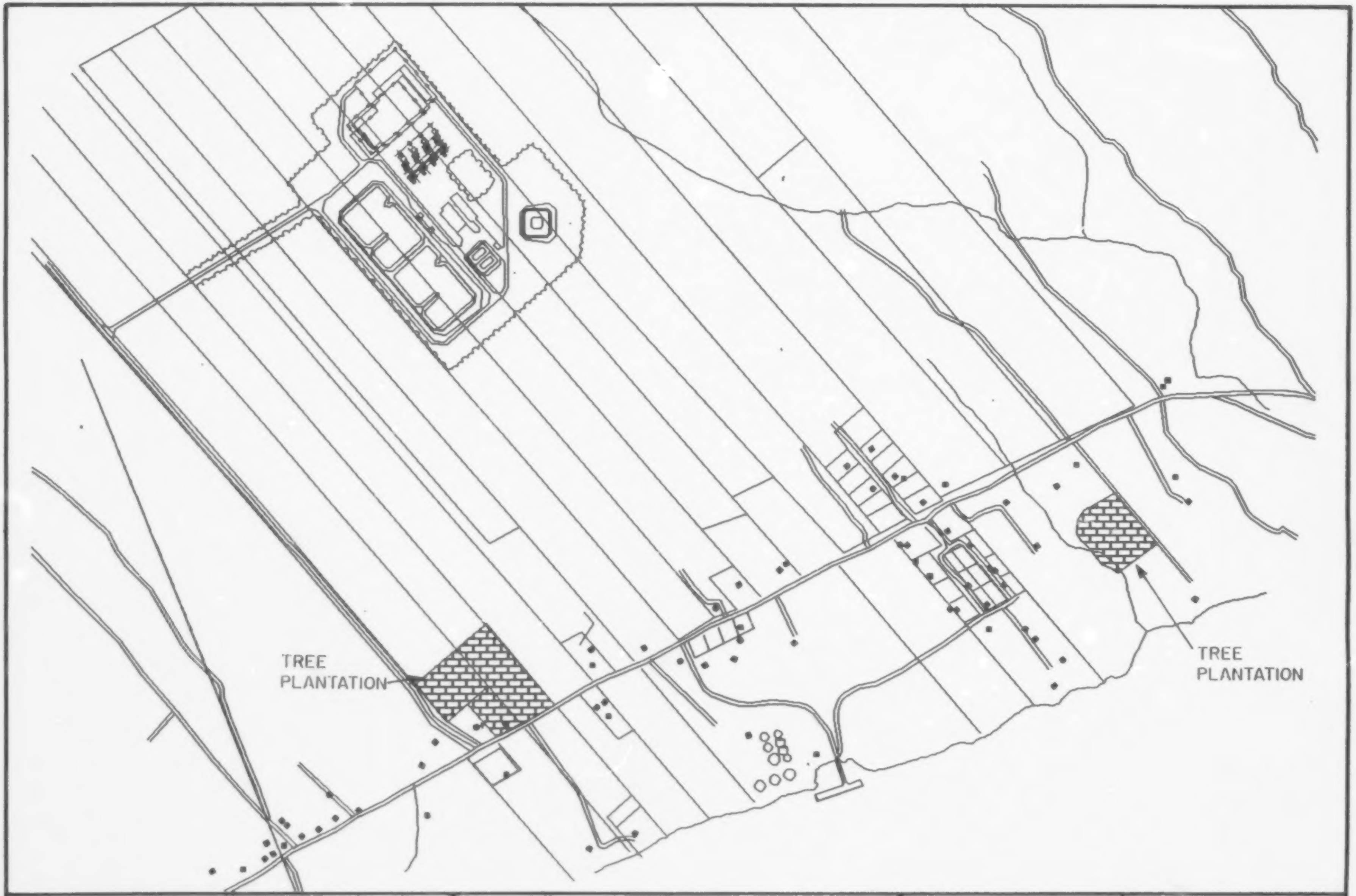
5.4.5 Relevant Legislation

There are no zoning regulations in effect in the area of the proposed site. Provincial legislation applicable to project implementation includes the:

- Assessment Act;
- Clean Environment Act, including regulations on:
  - Air Quality Regulation 83-208;
  - Environmental Impact Assessment Regulation 87-83;
  - Petroleum Product Storage and Handling Regulation 87-97; and
  - Water Quality Regulation 82-126;
- Community Planning Act;

CHRISTMAS TREE PLANTATION
FIGURE 5-5

CHRISTMAS TREE PLANTATION
FIGURE 5-6


TREE
PLANTATION
TREE
PLANTATION

LOCATION OF
CHRISTMAS TREE PLANTATIONS

DATE: 90 07 03

SCALE: NTS

FIGURE No.: 5-7

- Endangered Species Act;
- Fire Prevention Act;
- Fish and Wildlife Act;
- Health Act;
- Historic Sites Protection Act, and
- Public Utilities Act.

5.5 Transmission Lines

5.5.1 General Location

NB Power proposes to build transmissions lines from the proposed site northwest over private property and crown land. The proposed transmission lines turn in a westerly direction at the South Branch of the Bartibog River and will cross Route 8 and interconnect with NB Power's existing 230 KV transmission line number 2131.

The proposed location of the transmission lines is indicated in Figure 3-6. NB Power has obtained options on property necessary to accommodate this right-of-way.

5.5.2 Land Use

The proposed transmission line corridor will be 90 metres wide for the first three kilometres. The proposed transmission lines will interconnect with the existing 138 kV transmission line three kilometres from the site. The 230 kV interconnection will then proceed along a 40 m right-of-way for 10 km to meet NB Power's existing 230 kV line No. 2131.

Much of the land in question is undeveloped forest land; one half is crown land. A forest fire in 1986 burned approximately two thirds of the land which would be crossed by the proposed transmission lines. The Timber Management Branch of DNRE has indicated that there are no permanent sample plots (PSP) on the crown land which will be crossed by the proposed transmission lines. There are PSPs on private land in the Little Bartibog Brook area and in Russeliville; however, none exist on the land which will be traversed by the proposed transmission lines (D. Yeomans, pers. comm.).

The initial 3 km of the proposed route for the transmission lines is mainly over privately owned land. With the exception of crossing the newly aligned Route 8, the original Route 8 and two existing transmission lines (Nos. 0012 and 1106), this section of the proposed route is completely located on privately owned woodlots. The continuation of the 230 kV transmission line along its 10 km westerly route to its junction with the existing transmission line (No. 2131) traverses both privately owned woodlots and provincially owned crown forest land. The initial 2-3 km of this section of the proposed route (immediately northwest of intersection with transmission line (No. 1106) is on privately owned woodlots. The subsequent section (6 km) is located on crown land, but depending upon the exact routing, one or more small sections of privately owned may be crossed near the middle of this section. A dirt road, known as the O'Keefe Road, also crosses this section of the proposed route near its midpoint. The remaining 2 km of the western end of this proposed line again crosses privately owned land. At this western end of the proposed route, the transmission line will also cross the CN railway line, and the highway (Beaverbrook Road), before terminating at the existing transmission line No. 2131.

The entire length of the proposed transmission line is through forest land (private woodlots and forested crown lands) except for existing transmission line right-of-ways and highways. However, a significant portion of this forest land currently does not contain tree cover. A large forest fire in 1986 destroyed much of the tree cover along the mid section of the proposed route (approximately 5 kilometres). Some of this area (in the vicinity of the O'Keefe Road) has been treated (standing dead forest flattened by bulldozers) and replanted with nursery stock since the fire, but much remains untreated. An earlier fire (1984) burned an area of forest on the western end of the proposed route of the transmission line near its junction with line No. 2131. The proposed route crosses some areas of bog. Bogs in this area usually do not support productive forest stands. Trees in these areas are usually scattered and stunted.

5.6 Valued Socioeconomic Components

The most important issues and concerns from a socioeconomic perspective will be the potential effects of the proposed generating station on the patterns of human activity within the vicinity of the site and within Northumberland County. These include positive impacts on the local economy from increased levels of local employment and the economic spin-offs from investment during the construction phase of the project.

The major concerns stated by the local residents are:

- the effect of the project on property values in the immediate vicinity;
- the potential nuisance of noise from the facility;
- the change in the visual quality of the area;
- the potential effects on human health and on environmental receptors in the area from atmospheric emissions from the facility, and

- the amount of water the plant will require and the possible impact on the water table in the area.

There are concerns relating to the capacity of local government services to accommodate any possible population increase which might result from the construction of the facility.

Many of the Valued Socioeconomic Components are resource uses with significant economic importance, for example, the forestry industry. Other resource uses have economic, social and cultural value. Although data are generally only available for commercial activity, recreational harvesting and harvesting for home consumption, or to supplement household income, are also important. Many of the activities important to the region are therefore part economic, part recreational. For example, hunting and fishing form part of the lifestyle of the people who have traditionally lived in the area or who choose to move there. This concept is recognized in the literature. Clarke (1972) uses the term "occupational pluralism" to describe traditional patterns of combining many different activities, most of which rely on local resources, to produce income adequate to support a household. Such occupational pluralism is a means of risk minimization which is achieved in four ways: "sharing the tasks among members of the family, undertaking different activities at different seasons, migrating to increase opportunities for wage labour, and combining subsistence with commercial activity". Further, Bowles (1981) suggests that subsistence activities directed to the production of income in kind or to the direct production of commodities consumed within the local group and traditional economic practices which produce cash incomes should be considered in impact assessment.

Because of the importance of resource uses to these areas and the overlap between commercial and non-commercial activities, these components are addressed together.

Other Valued Socioeconomic Components identified are part of the existing local environment. These include the visual quality of the natural environment, air and water quality, and public health and safety.

The specific spatial boundaries of each of the Valued Socioeconomic Components identified in this EIA Study vary, depending on the extent of the impact on each component and the data sources available to measure the Component.

5.6.1 Quality of the Natural Environment

The quality of the natural environment has been identified as a Valued Socioeconomic Component. People depend on the natural environment for their continued well-being and therefore have a vested interest in maintaining its quality. From the residents' perspective, the natural environment provides recreation and resource harvesting possibilities. Economists attribute value to the natural environment for its option and bequest values. Option value is a valuation that covers an individual's wish to retain an option to make use of some facility or component of the environment sometime in the future. Bequest value is a valuation of an asset that an individual wishes to hand on to children or to future generations. On a longer term, the natural environment is valuable for preserving habitat, preserving clean air and maintenance of the quality of water. Preservation benefits have been recognized in the literature as valid considerations. For example, the Gordon-Below-Franklin hydroelectric project in Tasmania was cancelled because the analysis valued the preservation benefits higher than the benefits from the proposed development (Pearce, 1983).

5.6.1.1 Ambient Noise Levels

Residents in the vicinity of the proposed generating station, particularly residents of the Rockcliffe subdivision have expressed concern regarding noise from the operation of the facility. Section 4.6 of this study indicates the ambient noise levels in the vicinity of the plant. Ambient levels are greatest at peak traffic periods (0700-0800 and 1530-1730). Nighttime levels were between 21 and 25 dB(A). The major source of noise in the area is traffic on Routes 11 and 8. The planned realignment of Route 8 will bring it closer to the proposed site and will increase the level of noise in the vicinity. Other sources of sound in the area are distant rail traffic, distant industrial plants, barking dogs, wind, CFB Chatham air base, and vessel traffic in the Miramichi Channel.

5.6.1.2 Visual Quality

The proposed site for the Millbank TGS is in a semi-rural area on the outskirts of the Chatham/Newcastle urban agglomeration. Dwellings along Route 11 and in the Rockcliffe subdivision are interspersed with undeveloped agricultural and forest land. The area does not have zoning regulations and commercial development is interspersed amongst the residential areas. Many of the residences in the immediate area have been built within the last ten years.

The proposed site has mixed hardwood cover with areas of cleared land. The site is across the mouth of the Miramichi river from the town of Chatham.

5.6.2 Public Health and Safety

The general physical and psychological well-being of the population of a particular area is very difficult, if not impossible, to measure (Dr. D. Addleman, pers. comm.). There are no reliable indicators of physical or mental health. There are some indicators which provide a crude measure of the general health of an area; however, these indicators should be used with caution. Possible indicators of psychological health are rates of psychological morbidity, numbers of admissions to psychiatric units of hospitals or admissions to psychiatric clinics, suicide rates and unemployment rates (Dr. E. Niles, pers. comm.). Possible indicators of physical health are mortality and morbidity rates, life expectancy, admissions to hospitals and infant mortality rates.

There is very little published information regarding the general health and well-being of people in the study area. Any information available refers to specific illnesses or conditions, and even this information is limited. General information specific to the regions of the Province are not readily available (Dr. M. Sharp, pers. comm.).

Traffic safety in the areas around the proposed generating station is typical of the Province. Northumberland County had 7.6 percent of the traffic accidents in New Brunswick in 1988. The population of Northumberland County accounts for 7.6 percent of the population of the Province. The fatality rate for traffic accidents in Northumberland County is high at 14.2 percent of the fatalities in New Brunswick relative to the population (New Brunswick Department of Transportation, 1989).

5.6.3 Private Property

5.6.3.1 Property Values

Residents in the vicinity of the proposed project have expressed concern regarding the effect of the project on the value of their properties. Assessed values for properties in the Rockcliffe subdivision and other properties in the immediate vicinity of the site were obtained from the Assessment Office of the New Brunswick Geographic Information Corporation and were referenced to LRIS (Land Registry Information Service) and PAN (Property Assessment Number) numbers. According to the Assessment Office, these properties were reinspected in 1988, and are reassessed annually; the assessed values should represent "real and true" value with certain exceptions. Woodland, farmland and golf courses are assessed at below market value. Properties which are part of a subdivision but are still in the possession of the original developer could be assessed at below market value (L. McKenzie,pers. comm.). Local real estate agents have estimated $12,000 as a "ballpark" value for unserviced one acre lots in the Rockcliffe subdivision (B. Burchill, D. Tozer, pers. comm.).

5.6.4 Community Viability

5.6.4.1 Economic Viability of the Community

The economy of the study area is largely based on natural resources, particularly forestry resources. The economic viability of the communities is unstable as indicated by the high numbers of income assistance recipients. For this reason, there is a high incidence of resource harvesting to supplement incomes. Much of this economic activity is non-commercial and falls within the informal sector or underground economy. The study area, particularly the Chatham/Newcastle area has experienced considerable investment as indicated in Section 5.2.7. Employment in the area has increased with these developments.

5.6.4.2 Accommodations

The District Supervisor with the Department of Tourism Recreation and Heritage has indicated that the Chatham/Newcastle area has approximately 300 commercial hotel/motel units with a normal occupancy rate of over 70 percent. According to the District Supervisor, during the period from June to September the occupancy rate is close to 100 percent. Published occupancy rates are lower than actual occupancy. Table 5-11 shows roofed occupancy rates for the Fredericton to Chatham/Newcastle area for the years 1979 to 1989 (pers. comm. R. Savoir).

TABLE 5-11

ROOFED ACCOMODATION OCCUPANCY RATES FREDERICTON TO CHATHAM/NEWCASTLE

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	%	%	%	%	%	%	%	%	%	%	%
January	74	47	38	36	41	44	42	60	54.3	41.7	52.8
February	68	48	44	52	49	48	48	68	50.9	48.0	54.0
March	74	48	43	44	52	48	47	48	46.8	39.9	48.3
April	50	42	45	49	49	49	53	77	55.5	48.2	58.3
May	54	57	50	58	52	58	65	74	55.5	52.9	63.2
June	64	67	68	66	57	68	69	77	65.5	69.1	73.5
July	74	75	74	75	69	71	83	88	71.1	77.7	85.1
August	77	68	73	70	68	65	82	84	75.4	68.9	82.1
September	*	65	65	68	67	58	76	79	74.1	62.9	75.5
October	46	63	45	49	53	52	71	75	55.0	52.4	62.2
November	47	46	43	45	50	52	62	63	50.1	46.2	66.7
December	30	33	31	33	31	35	48	50	38.0	31.1	40.2

* Less than 25 percent of the units reporting

Source: New Brunswick Department of Tourism, Recreation and Heritage, pers. comm., 1990

5.6.4.3 Labour Force

Table 3-2 indicates the labour force requirements for the construction of the Millbank TGS. The Labour Market Information Analyst, Canada Employment Centre, for the Chatham/Newcastle area has reported that there is a shortage of workers in some trades, including:

- pipefitters;
- electricians;
- iron workers; and
- boiler makers (P. Richard, pers. comm.).

Other development projects in the northeast of the Province which will be employing construction workers and tradespersons during 1990 to 1991 include:

- the $6 million retail/office complex in Newcastle (will employ approximately 200 workers);
- senior citizens complex (will employ 50 to 80 workers);
- expansion of the Community College (will employ approximately 200 carpenters and tradespersons), and
- the Belledune generating station.

There is, however, a sufficient supply of labour in New Brunswick in most trades (P. Richard, pers. comm.). Mr. Richard indicated that the current unemployment rate in the

Chatham/Newcastle urban agglomeration is approximately ten percent; much lower than the regional rate of 19 percent for 1989.

5.6.4.4 Local Business Opportunities

The Chatham/Newcastle area has a typical range of service and support industries for a community of its size.

5.6.4.5 Community Services and Infrastructure

The site of the proposed generating station is located in the Ferry Road-Russellville Local Service District. Police service is provided by the Newcastle Detachment of the RCMP. Fire service is purchased from the Village of Douglastown. Health care services for the local service district are provided by the Hotel Dieu Hospital in Chatham and the Miramichi Hospital in Newcastle.

5.6.5 Tourism

According to the Department of Tourism, Recreation and Heritage, there are two Provincial Parks in the vicinity of the proposed Millbank generating station; The Enclosure and Middle Island. The Enclosure is a recreational park located southwest of Chatham/Newcastle on the Miramichi river. This park has 94 camp sites, 67 picnic sites and an unsupervised beach. The Enclosure beach was closed permanently in 1987 for safety reasons due to an undertow in the river. Camper attendance at The Enclosure is shown in Table 5-12 for the period 1985 to 1989. Attendance has dropped from the 1985 level and fluctuates on a yearly basis, likely reflecting weather conditions. Middle Island is located east of the proposed site across the Miramichi Bay and has 25 picnic sites and a supervised beach. Attendance at Middle Island beach during 1989 was 6,832, down from 13,466 in 1988. Both parks are open from June 26 until September 8 (New Brunswick Department of Tourism, Recreation and Heritage, 1990).

TABLE 5-12

Camper Attendance, The Enclosure

Year	Number of Campers (by permit)
1985	7,320
1986	6,335
1987	6,287
1988	2,448
1989	5,903

Source: New Brunswick Department of Tourism, Recreation and Heritage, 1990

5.6.6 Resource Use

Incremental additions to local acidic deposition on surrounding terrestrial and aquatic ecosystems have the potential to generate changes in the economics of local resource use. This section presents an overview of current local resource based economic activity.

5.6.6.1 Christmas Tree Plantations

Christmas tree plantations have been identified in the Guidelines and in the Terms of Reference as a Valued Socioeconomic Component. The Extension Forester at the Newcastle office of the Department of Natural Resources and Energy (DNRE) has indicated that there are approximately 80 Christmas tree growers within a 50 mile radius of the proposed generating station site (J. Stuart, pers. comm.). The largest concentrations are to the southeast and the northeast of the site. There are approximately 10,522 hectares of Christmas tree plantations in Northumberland County. The annual production from these plantations is 49,000 trees representing an annual revenue of $710,000. Values per hectare are dependent on tree size. Trees are generally planted at a density of approximately 2470 trees per hectare. The farm gate value of the trees at maturity is $15 to $17. The value of a hectare of mature Christmas trees is approximately $37,064 (B. Hamilton, pers. comm.).

5.6.6.2 Balsam Fir Tips Harvesting

Balsam fir tips are harvested for the construction of Christmas wreathes from mid-October until the first week of December. Between one-quarter and one-third of the foliage from the lower third of the tree is harvested. Balsam fir tips naturally regenerate within three years provided proper harvesting techniques have been used. Balsam fir tips are harvested from both private woodlots and crown land. Information is not available on the quantity of balsam tips harvested within a 50 kilometre radius of the proposed Millbank site. DNRE has estimated that in excess of two million wreaths are produced each year across the Province, generating farm-gate revenue of five to six million dollars per year. Historically this has been primarily a cottage industry, but in recent years factory-based commercial operations have been implemented to provide for the growing export demand for wreaths (B. Hamilton, pers. comm.).

5.6.6.3 Maple Sugar Producers

There are two commercial maple sugar operations within a 50 kilometre radius of the proposed site. The Newcastle office of DNRE has indicated that the producer near Neguac has 310 taps on maple trees in an area of approximately six hectares. The producer in Halcomb (near Red Bank) has 2500 taps on trees on an area of approximately 12 hectares (J. Stuart, pers. comm.). The maple sugar specialist for New Brunswick has indicated that a ballpark estimate of $15 per tap is appropriate to evaluate a maple sugar operation (D. O'Brien, pers. comm.). The total investment for the Neguac and Halcomb operations is $4650 and $37,500 respectively. The Extension Forester for DNRE in Newcastle has indicated that there are also numerous producers who manufacture small quantities for their own use. These producers have less than 700 taps each (J. Stuart, pers. comm.).

5.6.6.4 Hardwood Stands

There are stands of intolerant hardwoods (stands composed at least 60 percent poplar and white birch) scattered throughout the area within a 50 kilometre radius of the proposed site. The Timber Management Branch of DNRE has estimated that there are 58,086 hectares of intolerant hardwoods within a 50 kilometre radius of the proposed site (M. McDonald, pers. comm.). This represents approximately seven percent of the total land area within this radius.

5.6.6.5 Forest Nurseries

There is one forestry nursery producing softwood seedlings located within a seven kilometre radius of Newcastle. The MacTavish Nursery in Newcastle produces 11 million seedlings annually. Seedlings are started in greenhouses and hardened in the field (J. Stuart, pers. comm.).

5.6.6.6 Agriculture

Northumberland County has a total area of 1,214,754 hectares of which 202,515 hectares (less than 17 percent) is classified as "agricultural blocked area" by the New Brunswick Department of Agriculture. The term "agricultural blocking" is applied to:

> designated areas where there are a number of acres of land that display consistently high agricultural capabilities. This blocking has been done in an attempt to indicate where the agricultural potential of the Province may lie. It does not indicate or imply zoning or any attempt thereat.

Information on actual crops is available by region, but not by county. Most of Northumberland County is in Region 7 which has a total of 21,167 cleared hectares, 216.6 hectares in horticultural crops (vegetables and soft fruits) and 2,432 hectares in field crops (grains, potatoes, pasture, fodder), (New Brunswick Department of Agriculture, undated).

According to the Plant Industry Branch of the New Brunswick Department of Agriculture, the majority of agricultural land in the vicinity of the proposed turbine generating station is small scale, mixed family farms. There are commercial blueberry farms on the Miramichi Bay and along the Miramichi river (J. MacMillan, pers. comm.). The Provincial blueberry specialist has indicated that there are 101 hectares of commercial blueberries in the Neguac area (S. Michaud, pers. comm.).

5.6.6.7 Mining and Mineral Exploration

The Mining Recorder at the Minerals Branch of DNRE has indicated that there are no claims or mineral rights in the area of the proposed Millbank TGS and very little potential for metallic deposits. The DNRE geologist indicates that the mineral potential of the site is unknown (G. Greer, pers. comm.).

The peatland specialist at the Mineral Resources Branch of DNRE has indicated that there is no peatland development in the immediate area of the site (J. Thibeault, pers. comm.).

5.6.6.8 Aquaculture

According to the New Brunswick Department of Fisheries, there are large oyster beds in the Baie-Sainte-Anne and Bay du Vin areas. Annual production of oysters in the area is approximately 450,000 to 1,000,000 kilograms. There are also oyster beds in the Neguac area. There are two mussel growers in the area; in Baie-Sainte-Anne and Pointe au Carr. The producer in Baie-Sainte-Anne has been in business four years and plans to expand his operation (P. Cormier, pers. comm.).

5.6.6.9 Wild Food Harvesting

Local residents and families from the Chatham and Newcastle use the proposed Millbank site for harvesting blueberries, raspberries and strawberries. The site property is a known locally as a good place to pick blueberries. Some local residents trap rabbits as a hobby or hunt deer and small game on the site. (C. Fracker. pers. comm.).

5.6.7 Recreation

5.6.7.1 Non-Consumptive

Birdwatching is a popular recreational activity within a 50 kilometre radius of the proposed generating station site. A naturalist from Douglasville has indicated that there are three organizations and many individuals in the area interested in this activity. The organized groups include:

- the Miramichi Naturalists Association;
- The Neguac club;
- Club de Naturalists de la Péninsule Acadienne.

Birdwatchers in the area have identified approximately 200 species (including migratory species) and conduct monthly and annual bird counts. Popular birdwatching venues include the Portage Island Wildlife Area and the Kouchibouguac Barrier Sand Dunes (T. Greathouse, pers. comm.).

Other non-consumptive recreational activities include hiking, cross-country skiing, and snowmobiling.

5.6.7.2 Consumptive

The Miramichi area of Northumberland County is internationally known as a salmon fishing area. Major rivers for angling include the:

- Southwest Miramichi;

- Tabusintac;
- Bartholomew;
- Bartibog;
- Cains;
- Dungarvon;
- Little Southwest Miramichi;
- Nepisiguit;
- North Pole;
- Northwest Millstream;
- Northwest Miramichi;
- North Branch Sevogle;
- North Branch Renous;
- Northwest Branch Little Southwest Miramichi;
- Renous;
- Sevogle, and

- South Branch Sevogle.

In addition there are two rivers in the Miramichi drainage basin designated "intermittent sport" which support angling some years and two "non-sport" rivers which do not provide salmon angling but support juvenile and spawning salmon populations (New Brunswick Department of Natural Resources and Energy, pers. comm., 1990).

Table 5-13 shows the salmon harvested in the Miramichi drainage in Northumberland County for 1971 to 1988. Numbers of total fish, grilse, and salmon harvested have increased over this period. Linear regression analysis of the data shows a net increase of 66 percent over 17 years, or an annual average increase of 734 fish per year. There has been a hook and release program for salmon since 1984 (after 1984 the total "harvested" is the number of grilse harvested and the number of salmon caught and released). According to the Fish and Wildlife Branch of DNRE, the increased harvests are due to the delay in the start of the commercial fishery on the west coast of Newfoundland from May 20 to June 10 and to the 1984 ban on commercial salmon fishing in New Brunswick (W. Hooper, pers. comm.).

Table 5-14 shows the estimated number of rod days spent by anglers on the Miramichi drainage basin and the total expenditures for resident and non-resident anglers for 1988 in the Province. Data is not available for the Miramichi drainage. The number of resident anglers is approximately four times the number of non-resident anglers.

5.6.8 Historical and Archaeological Resources

The Archaeology Branch of the Department of Tourism, Recreation and Heritage has indicated that there are no archaeological sites on the proposed generating station site and the property does not appear to have high potential. There are sites located along the banks of the Miramichi River; the closest location is on the Bartibog River (A. F Ferguson, pers. comm.).

TABLE 5-13

Salmon Harvested - Miramichi Drainage
(Northumberland County)

Year	Grilse	Salmon	Total Fish Harvested
1971	13,727	1,792	15,519
1972	19,101	8,933	28,034
1973	13,858	5,977	19,836
1974	18,232	7,183	25,415
1975	15,598	6,287	21,885
1976	27,182	7,375	34,557
1977	13,590	11,616	25,557
1978	8,265	4,892	13,157
1979	14,510	2,656	17,166
1980	11,999	6,546	18,545
1981	22,719	3,240	25,959
1982	21,402	4,608	26,010
1983	8,390	2,240	10,630
1984	18,794	7,690	26,484
1985	18,440	9,620	28,060
1986	26,163	14,266	40,429
1987	20,765	11,932	32,697
1988	30,620	10,095	40,715

Source: New Brunswick Department of Natural Resources and Energy, pers. comm., 1990

TABLE 5-14

1988 Atlantic Salmon Angling, Miramichi Drainage

	Estimated Rod Days	Total Expenditures (Provincial)
Residents	63,212	$6,933,724
Non-residents	15,803	$7,409,394

Source: W. Hooper, pers. comm., 1990

The Department of Natural Resources and Energy has identified Wilson Point as being potentially significant since it is an archaeological site.

5.6.9 Transportation Network

The site is located on the McHardy Road approximately 1000 m north of the intersection with Route 11. Route 11 is a paved two-lane Provincial arterial highway linking communities on the east coast of New Brunswick. This section of Route 11 is straight and flat. The Average Annual Daily Traffic count for Route 11 between Newcastle and Neguac (7.5 km northeast of the interchange of Routes 8 and 11) is shown on Table 5-16. This is a temporary counter that is artificially high (A. Steeves, pers. comm.). Linear regression analysis of the data indicates an average annual increase of 139 vehicles, a 40 percent increase over the eight year period. Table 5-16 shows details of accidents occurring on Route 11 from 1986 to January 1990 between the intersection of Routes 11 and 8 and the Gum Road. The table shows the severity of accidents and the location where accidents occurred. During this period there were a total of 94 accidents; 64 involving property damage, 27 involving personal injury and three involving a fatality. The proposed site is located on this portion of Route 11.

The McHardy Road is straight and flat where it passes the location of the proposed TGS site. It has a sandstone/gravel surface and is classified "local" with a spring load restriction of 80 percent (W. Row, pers. comm.).

TABLE 5-15

Average Annual Daily Traffic Count Route 11*

Year	AADT
1981	2400
1983	2570
1985	2990
1987	3180
1988	3350

* 7.5 Kilometres Northeast of Intersection of Routes 8 and 11.

Source: A. Steeves, pers. comm., 1990

TABLE 5-16

Traffic Accidents Route 11, Intersection Route 8 To Gum Road, 1986-1990

DATE	POSITION WITHIN SECTION (KM)	ACCIDENT SEVERITY +
87 1 26	.0	1
87 3 12	.1	1
87 3 12	.1	1
87 8 31	.1	1
88 2 12	.1	1
88 12 27	.1	1
89 2 11	.1	1
88 10 3	.1	2
88 12 13	.1	1
88 10 14	.2	1
89 1 13	.2	1
86 12 12	.3	2
88 1 30	.4	2
88 12 24	.4	2
89 7 3	.7	2
89 2 19	.7	1
88 9 20	.7	1
89 7 5	.7	2
89 6 6	.7	2
89 9 22	.8	2
90 5 21	.8	1
89 7 18	1.6	2
89 8 27	1.7	2
86 7 28	2.0	2
86 6 10	2.0	2
88 1 17	2.0	1
87 5 9	2.1	2
86 7 18	2.4	2
87 3 16	2.4	1
88 4 14	2.4	3
87 12 25	2.5	1
86 9 5	2.6	2
88 11 6	2.6	1
89 11 19	3.1	1
89 4 26	3.4	3
89 7 27	3.5	1
90 5 22	3.7	2
88 3 17	3.9	1
86 9 28	4.1	1
88 4 11	4.2	1
88 6 15	4.2	1
87 12 6	4.3	1
88 10 25	4.6	1

TABLE 5-16 (Continued)

Traffic Accidents Route 11, Intersection Route 8 To Gum Road, 1986-1990

DATE	POSITION WITHIN SECTION (KM)	ACCIDENT SEVERITY +
88 9 7	4.9	1
86 2 28	5.2	1
86 12 8	5.2	1
89 10 11	5.2	1
88 12 20	5.3	1
87 3 18	5.7	1
87 11 24	5.7	1
90 5 5	5.8	2
88 2 18	5.9	1
89 6 29	5.9	1
90 1 26	5.9	1
86 3 9	6.0	1
87 2 26	6.0	1
88 1 13	6.0	3
89 7 30	6.0	2
87 4 29	6.2	1
89 7 25	6.5	2
89 2 20	6.8	1
89 8 10	6.8	1
89 9 7	7.1	1
88 12 29	7.3	2
87 2 21	7.6	1
89 11 12	7.6	2
89 2 4	8.0	1
87 7 9	8.2	2
88 4 16	8.4	1
87 10 18	8.8	1
87 2 16	9.1	2
87 8 5	9.3	1
88 1 14	9.8	1
89 11 9	10.0	1
86 10 31	10.3	2
90 5 6	11.0	1
89 3 21	11.1	1
90 2 17	11.1	1
87 8 6	11.3	1
88 12 9	11.3	2
89 4 8	11.4	1
89 9 19	11.6	1
89 1 20	11.8	1
89 9 23	12.2	1
86 8 2	12.5	1
89 10 21	12.5	2

TABLE 5-16 (Continued)

Traffic Accidents Route 11, Intersection Route 8 To Gum Road, 1986-1990

DATE	POSITION WITHIN SECTION (KM)	ACCIDENT SEVERITY +
88 6 26	12.5	1
87 11 3	13.0	1
86 4 9	13.1	1
87 11 3	13.1	1
88 12 23	99.9	1
89 1 12	99.9	1
88 12 31	99.9	1
89 7 23	99.9	1
90 2 27	99.9	1

+ Accident Severity: 1: Property Damage, 2: Personal Injury, 3: Fatality

SOURCE: D. Mason, pers. comm.

CHAPTER SIX

CONSTRUCTION PHASE EFFECTS

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6.0 CONSTRUCTION PHASE EFFECTS

6.1 Biophysical

6.1.1 Plant Site

6.1.1.1 Potential Effects

Sources of measurable or potential environmental effects during the approximately 19 month construction period will include:

- the clearing and disturbance of land for the installation of power plant facilities;
- surface runoff from cleared and unstabilized areas;
- dust emissions associated with traffic and construction activities, and
- noise from traffic and construction activities.

The installation of the power plant will involve the clearing of approximately 23 ha. Within this area, approximately 10 ha will be excavated or otherwise stripped of topsoil to enable the construction of ponds, foundations, roads, pipeline and other power plant facilities.

6.1.1.2 Control Measures

Site clearing will be initiated during the summer period of relatively low rainfall. This will minimize the generation of runoff from the area until erosion protection structures can be put in place. Any runoff from neighbouring areas will be diverted away from the construction area. All runoff from disturbed areas will be directed into sedimentation ponds prior to overflow into the local watershed.

In order to limit potential erosion, only the minimum area will be cleared, with buffer zones left between cleared areas, including roads, and water bodies if possible. As a general rule, NB Power will respect the procedures prescribed by the New Brunswick Department of the Environment for the control of erosion and protection of watercourses, which are routinely appended as conditions for Watercourse Alteration Permits in the Province.

It is intended that all slash produced during the clearing operations will be either chipped or burned onsite. All merchantable timber will be removed. Remaining stumps and other material removed in grubbing will be used as fill material in the downslope containment berm forming part of the sound damping system.

The construction access road will be paved which will minimize dusting from construction traffic. Dust emissions will be further controlled by watering as required. Road grades and ditches along this route will be designed to limit erosion.

When construction is completed in equipment laydown areas, foundation spoil areas will be graded and grassed to prevent dusting.

Construction of the power plant would occur during a 12 to 18 month period. Most of the construction would occur during daytime periods. However, critical work could require some of the construction to occur on a 24 h/d basis.

Noise emissions would occur throughout the construction period as a result of the activities typical of all construction sites in the Province. During this period, the levels of noise would be expected to vary from approximately 60 to 72 dB(A), measured at a distance of approximately 120 m from the construction site (Teplitsky, 1978). Such noise would result in the sound levels given in Table 6-1 for the habitated locations nearest the

TABLE 6-1

Sound Levels - Construction Period (dBA)

Location[a]	Time Period	
	0700-2300	2300-0700
1	33-42	30-39
2	38-45	35-43
3	35-43	32-40

[a] - refer to Figure 4-10

proposed power plant site, at a distance of some 750-800 m from the closest boundary of the area to be cleared. The estimates given in Table 6-1 indicate that the levels of noise during daytime construction periods will not exceed those levels that currently occur in the area due to traffic and other sources of noise (Section 4.6). Some restriction on types of activities carried out during any nighttime construction periods will ensure a level of sound that is consistent with the existing situation. The absence of sensitive wildlife habitat at or near the site and the "conditioning" of the area by the present levels of sound will mitigate any effects of noise on wildlife due to construction of the power plant.

The noise during daytime and early evening hours, as a result of traffic and construction activities, will be at acceptable levels based on current baseline conditions at the nearest receptors in the area. Reduced construction activity at night will ensure that noise levels do not exceed the prescribed maximum of 40 dB(A).

6.1.1.3 Residual Effects

The only long term effect of site construction will be the marginal impact of taking 23 ha out of forest production for the life of the plant.

6.1.2 Transmission Line Construction

6.1.2.1 Potential Effects

The potential environmental consequences of transmission line construction will be the removal of tree cover from within the proposed right-of-way, as well as soil erosion and its impacts on nearby waterbodies.

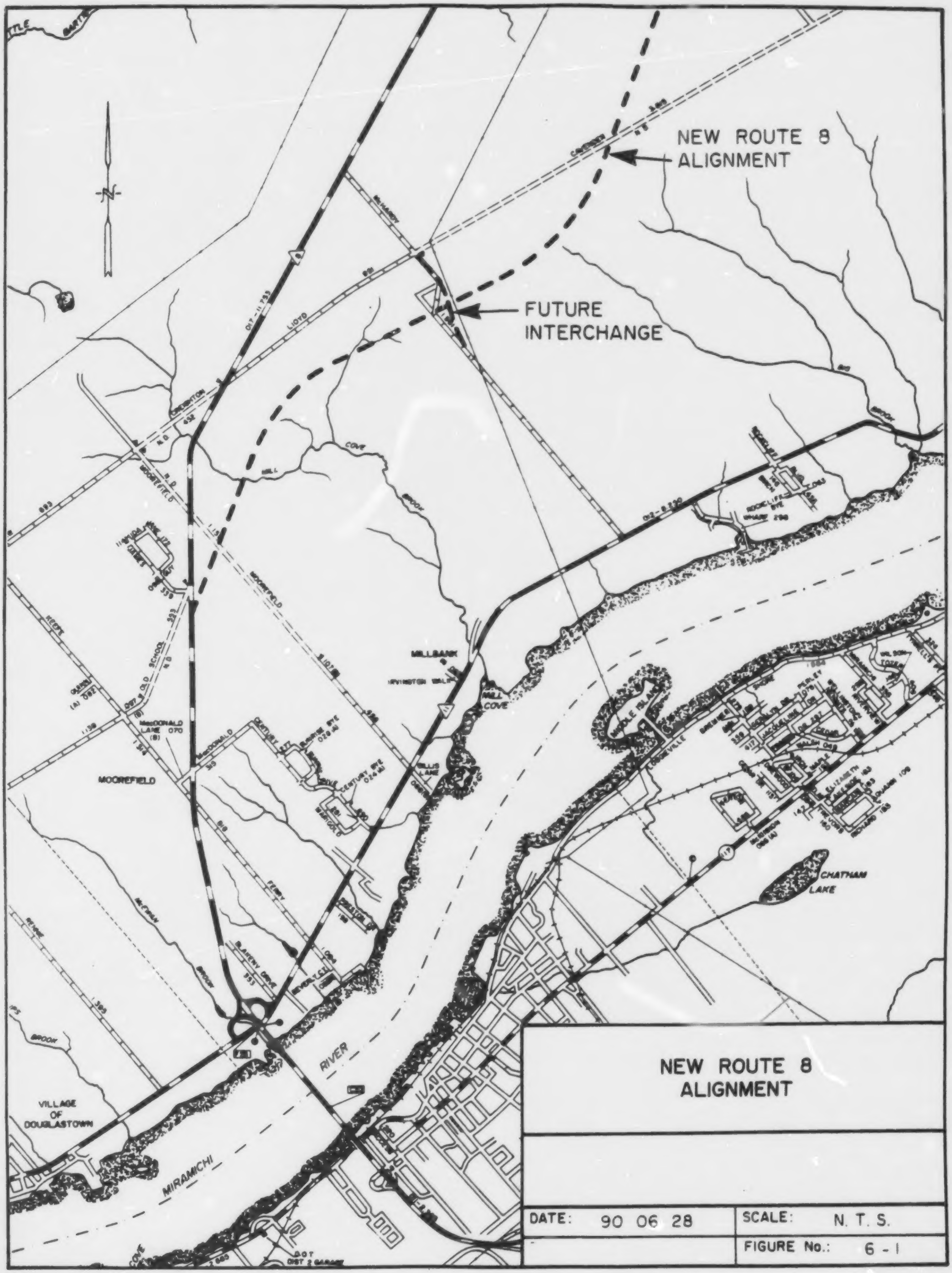
As previously stated, the proposed transmission lines will involve three parallel lines running northwest from the site for approximately 3 km to the existing 138 kV line (No.

1106). At this point, two of the proposed lines will terminate, while the remaining line (230 kV) will then run due west for a distance of approximately 10 km before terminating at an existing transmission line north of Newcastle (No. 2131). The initial 3 km of the proposed transmission lines (containing the 3 parallel lines) will be cleared of forest cover to a width of 90 m. The remaining 10 km route for the 230 kV line will be cleared to a width of 38 m. The proposed rights-of-way for the transmission lines for the Millbank generating station will therefore involve a total area of approximately 65 ha. If the current rights-of-way for the existing roads, highways, railway line and transmission lines crossed along the proposed route are discounted, the proposed transmission lines will be responsible for removing approximately 60 ha of "forest land" from production.

The Department of Transportation plans a new alignment of Route 8 as indicated in Figure 6-1. There are long term plans for an interchange to connect the new re-aligned Route 8 with McHardy Road. However, this will be located to the west of McHardy Road and will not conflict with the proposed transmission line right-of-way.

There are no deer or moose wintering areas, or other sensitive terrestrial wildlife habitat, in the vicinity of the proposed transmission lines.

The proposed route of the 230 kV transmission line crosses the South Branch of Little Bartibog River as well as a headwater tributary of this stream further to the west. Depending on the exact placement of the route, a headwater tributary of the North Branch of Little Bartibog may be crossed, as well as the headwater tributaries of Highbank Brook, a tributary of the Northwest Millstream. Both the Northwest Millstream and Little Bartibog River support very intensive fishing for both native and sea-run brook trout. Atlantic salmon also spawn in both of these systems. The salmon are fall-run fish and enter these systems after the legal angling season has closed, and therefore do not provide much angling opportunity. Juvenile salmon inhabit these waters throughout the year, spending 2-3 years in these waters before migrating to sea. Smelt spawn in the lower sections of


N
NEW ROUTE 8
ALIGNMENT
FUTURE
INTERCHANGE
LLOYD
CREIGHTON
MOOREFIELD
MILLBANK
MILL
COVE
BROOK
MIDDLE ISLAND
CHATHAM
LAKE
VILLAGE
OF
DOUGLASTOWN
MIRAMICHI
RIVER
D.O.T.
DIST 2 GARAGE

NEW ROUTE 8
ALIGNMENT

DATE: 90 06 28

SCALE: N. T. S.

FIGURE No.: 6 - 1

these streams. Lamprey eels and threespine stickleback are known to occur in Little Bartibog.

The construction of the transmission line could potentially affect future residential land use, especially where the line crosses Route 8 and the Bellefond Road.

6.1.2.2 Control Measures

Clearances must be maintained between vegetation and transmission lines, therefore vegetation within a right-of-way must either be altered or removed. The general method of removing vegetation [illegible] clear cutting the full width of the right-of-way for construction purposes. Vegetation control along the right-of-way will be required to remove growing trees. The appropriate sections of NB Power's Environmental Protection Plan for the Construction and Maintenance of Transmission Lines in New Brunswick will be implemented during construction clearing of the right-of-way. A walkover vegetation survey will be conducted along the centreline of the proposed transmission routes prior to full clearing of the rights-of-way, to ensure that the routes do not disturb rare or endangered plant species.

The control of erosion along transmission line routes will be be achieved through prior planning. During construction, care will be taken in spoil disposal to prevent erosion. Control measures also include spreading slash on disturbed areas, and installing buffer or sediment traps. Once pole placement has been completed, stabilization of cover vegetation will be made as quickly as possible. Rapidly growing grasses, shrubs, mulches, and fibrous netting can be utilized to implement this stabilization procedure. Diversions and terraces will be employed to divert water around the critical areas along the line.

Protection of waterways during construction can be accomplished by placement of temporary diversions or by other measures specified in the New Brunswick Department of the Environment Protection practices.

The Environmental Protection Plan referred to above includes a series of measures to protect watercourses, such as:

(a) watercourse buffer strips (vegetation) will remain after clearing as follows:

Slope of Bank	Min. Horizontal Strip Width from high water mark
0 to 5%	15 metres
6 to 10%	30 metres
Greater than 10%	60 metres

This rule for watercourse buffer strip width is intended primarily for smaller streams. Major streams, rivers and lakes may require wider strips. The following factors make wider strips desirable.

(a) unstable soils
(b) fish spawning and nursery areas
(c) aesthetics
(d) recreation use
(e) wildlife wintering areas or habitat needs.

(b) No wheeled or tracked harvesting equipment shall be permitted to work within 10 metres of the edge of any watercourse and no harvesting will be permitted within a prescribed buffer zone.

(c) Vehicles shall not travel through streams or along stream bottoms. Whenever stream crossings are necessary, culverts shall be used and constructed as per regulations in the New Brunswick Crownlands Act.

(d) No tops, slash or debris from harvesting shall be allowed to enter any watercourse.

6.1.2.3 Residual Effects

Since erosion will be controlled throughout the length of the transmission line corridor, the only residual effect will be the permanent removal of forest cover from along the corridor. Forest cover would be removed in favour of shrubs or grasses which would not create any clearance problems. A transmission line corridor in forested areas would tend to promote successional growth and increase the numbers and variety of plant and animal species.

It is estimated that the proposed transmission line corridor would involve approximately 60 ha of forested land. Approximately one half (30 ha) of this total is crown land that is currently part of the Miramichi License No. 4. This license is one of two blocks of crown land leased to Miramichi Pulp & Paper Inc. and various sublicensees. The removal of 30 ha of wood production from the total area of these two licenses (726,650 ha) would have no noticeable effect on the wood supply of local industries.

It is estimated that the transmission line corridor will at most affect a total of six building lots on the existing Route 8 and the Bellefond Road. The removal of six potential building lots would have no significant effect on residential development in the area.

6.2 Socioeconomic

Potential socioeconomic effects from construction activity associated with the project include:

- effects on the natural environment, including construction noise, dust, and visual impacts;
- increased traffic on Route 11;
- effects on the local and Provincial labour force;
- effects on the Provincial economy;
- effects on local business opportunities;
- effects on community services and infrastructure;
- effects on tourism in the study area; and
- effects on future residential land use.

6.2.1 Natural Environment

6.2.1.1 Potential Effects

Construction activity associated with the project will create noise, dust and visual impacts associated with the equipment, deliveries, and work force in the area. These impacts on the natural environment could affect the people living in the immediate area. The residents of the Rockcliffe subdivision have expressed concern that construction workers will use the Rockcliffe road and might live in mobile homes or trailers on the construction site.

The noise levels during the construction phase of the project are expected to be comparable to the daytime ambient noise levels, as demonstrated in Section 6.1.1 above.

Construction activities are short term (19 months). The actual construction site is approximately 1300 m from the nearest residence. The buffer area around the site is covered with mixed hard and soft woods except for a 18 hectare cleared area at the end of the Rockcliffe subdivision road. The tree cover and distance from the local residences will mitigate significantly the potential visual intrusion and nuisance from construction activities.

6.2.1.2 Control Measures

The access road will be paved to minimize dust, and further controls will be implemented as required.

Construction activity that will create disruptive noise will be limited to daylight hours where feasible.

NB Power will develop on-site procedures to address the concerns of local property owners, including:

- restriction of construction traffic to the access road on the site;
- the prohibition of trailers and mobile homes on the construction site for purposes other than the project office, including lunch and storage rooms; and
- a system whereby construction personnel record and communicate to NB Power complaints from local residents, so that appropriate measures can be implemented.

6.2.1.3 Residual Effects

Nighttime noise levels will be in excess of ambient noise levels, if construction activities are carried out on a shift basis. This could be a temporary nuisance to the residents of the Rockcliffe subdivision.

6.2.2 Traffic

6.2.2.1 Potential Effects

Traffic generated by the construction activities of the project will be primarily from the work force, but also from equipment and materials deliveries. The peak construction period will be from February to September, 1991. It is estimated that there will be in excess of 210 person months of labour in May, June, July and August of 1991. Most of the labour force will be employed at the Millbank site. There will therefore be in excess of 200 vehicles traveling to and from the site twice daily during this four-month period. This may increase the potential for accidents on Route 11 where vehicles would turn onto the McHardy Road. Parking space for over 200 private vehicles, trucks and equipment will be needed on the site property.

A projected average annual daily traffic count for 1991 on Route 11 within four kilometres of the site can be estimated using linear regression analysis on the data shown in Table 5-15. An extrapolation of the linear regression analysis on the 1980 to 1988 data gives an estimated average annual daily traffic count of 3640 at the current rate of increase without construction related traffic and 4140 with increased traffic due to the construction of the Millbank TGS (assuming an increase of 250 vehicles or 500 round trips) or a 13.7 percent increase over naturally generated traffic growth. While this is a significant increase in traffic, its impact is short term and temporary in nature.

In 1989, there were nine accidents along control section 12 of Route11, which includes the intersection of Route 11 and the McHardy Road. Based on the 1989 accident figure, the accident rate along this section of highway is one accident for every 158,638 vehicles travelling the section of highway. The total increase in traffic will be 500 vehicles per day or a total of 61,500 vehicles during the peak construction period from May to September, 1991. Based on the accident rate of one accident (includes all types of accidents) for every 158,638 vehicles, the additional traffic on Route 11 as a result of the construction of the Millbank TGS should not significantly increase the accident rate.

6.2.2.2 Control Measures

A left turn lane off Route 11 onto the McHardy Road to the site could be constructed to minimize delays and potential accidents; however the New Brunswick Department of Transportation usually requires approximately 500 to 600 left-turning vehicles per day to warrant a left turn lane. Appropriate signage should be located at the intersection of Route 11 and the McHardy Road warning vehicles of truck turnings.

The 23 ha cleared area will include parking for construction activities on the site property could be used to park vehicles.

6.2.2.3 Residual Impacts

There will be an increase in traffic on Route 11 for the period of construction.

6.2.3 Labour Force

6.2.3.1 Potential Effects

A total of 251 person years of employment will be created over the 19 month construction period of the project. The majority of the jobs will be in the construction trades, particularly electricians, pipefitters, millwrights, iron workers and boilermakers. The majority of the work force will be unionized, the major exception being the ten labourers employed for clearing and grubbing the right-of-way for the transmission lines.

Using the employment multiplier from the 1979 Statistics Canada Input-Output Model for construction jobs in New Brunswick (the latest available), it is estimated that a total of 495 direct and indirect person years of employment will be generated by the construction of the project. In addition there will be induced employment resulting from the incremental household spending in the area. Induced employment is defined as jobs that will be generated through incremental household spending due to general economic expansion in the area.

The total expenditure on labour during the construction phase of the project is estimated to be $21,897,500. Ninety-five percent of this expenditure ($20,802,625) will be spent in New Brunswick. Using the labour income multiplier from the Statistics Canada 1979 Input-Output Model, it is estimated that a total of $32,734,500 in direct and indirect labour income will be generated in the Province over the construction period.

6.2.4 Provincial Economy

Major construction projects create incremental demand in the Province with benefits to the general economic development of the Province. The total expenditure for the construction of the Millbank TGS has been estimated to be approximately $252,000,000 with a total approaching $69,000,000 to be spent in the Province. The major expenditures within the Province include equipment rental, labour, land and right-of-way acquistion, and services to business. It is anticipated that the project will have a positive effect on economic growth in the Province.

6.2.4.1 Economic Offset

Subsequent to the submission of the EIA for the Millbank TGS, NB Power signed a contract with Asea Brown Boveri Inc. (ABB) for the supply and installation of five turbine generators for a total of $115 million. Four of the generators will be utilized at the Millbank TGS. ABB has committed to an associated economic offset package which is expected to have a significant positive economic impact in the Province. This section has been added to the Environmental Impact Assessment Report to explain this additional benefit to the Province.

NB Power Offset and Tendering Policy

NB Power is committed to a policy of open, competitive tendering, but one which, where possible, will enhance business development in the Province by the purchase of goods and services with the maximum New Brunswick content where price and quality are comparable.

Where it is not feasible or economically attractive for the supplier to manufacture components or materials directly related to the equipment covered in a tender or purchase services directly related to a tender in the Province, NB Power invites tender proposals to include provisions for off-setting New Brunswick purchases. This process, commonly referred to as OFFSET business, includes the enhancement of economic development in the Province by matching all or part of the dollars in a major purchase by the Corporation with additional export purchases, employment generation or investment within the Province.

Asea Brown Boveri Offset Commitment

In connection with the contract to supply and install five combustion turbine generators, has committed to undertake offset activities in the amount of 50 percent of the contracted price of $115 million. Four-fifths of the economic benefit to be derived in the Province from this offset business is directly related to the Millbank TGS. The offset will be realised through the creation of jobs in the Province of New Brunswick resulting from investments and technology transfer, as well as through exports of products, consumption of services and/or realisation of projects. Details of the potential components of the offset program are described below.

In addition to the above 50 percent offset a constituent part of the program will be a 17 percent Provincial content consisting of:

- installation related labour, material and equipment; and
- capital equipment and material used in the project.

The above expenditure was included in the estimate of the total New Brunswick expenditure in section 3.8.2.

The total New Brunswick benefit resulting from this offset program will therefore amount to 67 percent of the contract price, or $77,050,000. The benefit associated with the Millbank TGS portion of the offset program is $61,640,000.

Economic Benefits within the Province

Direct beneficiaries of the Offset Program will be existing and/or new companies in the Province of New Brunswick to be selected by ABB.

The components of the Offset Program may consist of:

- the creation of 50 to 70 jobs in the Province of New Brunswick resulting from investments by ABB and/or third parties which ABB has induced to invest;
- offset credits will be granted by NB Power and the administering government authorities for investments including:
  - equity capital;
  - jobs created through such investments;
  - exports generated through such investments;
  - imports substituted thereby; and
  - value of technology transferred.
- technology transfer through acquisition, licence agreements or know-how arrangement to be concluded with technology owners from outside New Brunswick (technology transfer). Special emphasis will be put on advanced technologies with importance for the development of technologically intensive sectors of industries;

- inclusion of local companies in planning and/or realisation of ABB's projects outside New Brunswick; and

- ABB's own purchases and incremental exports (export volumes exceeding the average yearly export achieved in the respective product sector by the respective parties during 1988 and 1989) of traditional and non-traditional projects outside New Brunswick (parallel-purchases).

The Offset Program will be structured as follows:

- 30 percent of the contract price will include the creation of 50 to 70 jobs in the Province resulting from investment and technology transfer projects; and

- 20 percent of the contract price will be offset through exports of New Brunswick products and/or services to partners and designations of ABB's choice.

Asea Brown Boveri will fulfil its commitment under the Offset Program through its own investments and its own technology transfer and will actively approach interested third parties to invest and to transfer technology with a view to the establishment of long term business relationships with New Brunswick.

Job creation associated with the economic offset will occur within a period of two years from the date of the signature of the contract. All other components of the Offset Program will take place within a period of four years from the date of the signature of the contract.

Special attention will be given by Asea Brown Boveri to the placement of orders with firms with existing connections to the ABB Group.

Indirect and Induced Benefits

In addition, indirect and induced benefits to the general economic environment in the Province are anticipated from the employment generated directly by the Offset Program.

The specific components of the Offset Program have not yet been negotiated. A minimum of fifty jobs will be created. It is not possible to apply the Statistics Canada Input-Output Model without knowing the sector in which the employment will be created. However, using an average multiplier for industrial sectors where direct employment is probable, it can be anticipated that between 76 and 115 direct and indirect jobs will be created as a result of this offset program. Four-fifths of these will be as a result of the Millbank TGS.

In addition to direct and indirect employment, induced jobs will be generated by the increased rounds of household spending in the Provincial economy. Induced employment is determined by the number of jobs in the base (or export) economy in the Province.

It will not be possible to calculate the full extent of the economic benefits associated with this Offset Program because details have not yet been determined. It can, however, be anticipated that New Brunswick will receive significant economic benefits as a result of this aspect of the Millbank TGS.

6.2.5 Local Business Opportunities

As indicated on Table 3-4, it is estimated that there will be an expenditure of almost $9,000,000 on equipment rental. Much of this will be spent in the study area, particularly in Chatham/Newcastle. Another expenditure of almost $9,000,000 is estimated for services to be purchased in New Brunswick. In addition, the majority of the construction work force is likely to live in the Chatham/Newcastle area, at least during the week.

Expenditures for services, accommodation, gasoline, and food will contribute to the local economy during the construction period.

6.2.6 Community Services and Infrastructure

6.2.6.1 Potential Effects

Major construction projects have the potential to generate economic development in communities, but can temporarily over-burden the existing community services and infrastructure without adding to the tax base. The major impact of this construction project on the local communities is the in-migration of the work force. This will generate positive impacts for the hospitality trade and local businesses.

While it is not possible to estimate the number of in-migrants to the area, there are reasons to assume that the majority of the work force will be from outside the Chatham/Newcastle area:

- there are several other major construction projects in the area, including:
    - a $3.4 million shipbuilding museum;
    - a $6.0 million retail/office complex in Newcastle;
    - a new $6.5 million boiler at the Repap Kraft Plant;
    - the $13.5 million renovations at Atlantic Waferboard; and
    - a $5.5 million expansion of the New Brunswick Community College.
- the necessary skills and trades are not all available within the local labour

force (P. Richard, pers. comm.); and

- NB Power cannot adopt a policy to employ local residents because hiring will be union controlled.

Accommodations in the area include:

- 402 hotel/motel units within commuting distance of Chatham/Newcastle;
- 14 trailer/mobile home parks;
- rental accommodations; and
- boarding house/billeting.

Discussions with the Miramichi Regional Development Commission and the Town of Chatham indicate that two new local hotel/motel establishments are in the planning stages. The number of rooms to be developed is not known, but it is unlikely that these would be brought on stream until late 1991.

It has been estimated that 95 percent of the labour force will be from New Brunswick. For the most part, each individual in the work force will likely be employed for less than 12 months. It is assumed that many trademen will return home on weekends and that few families are expected to accompany workers.

Experience with the construction of the Dalhousie generating station and the Mactaquac Dam suggests much of the work force will be accommodated in boarding houses or by informal billeting arrangements. Trailer/mobile home parks are also frequently utilized by members of the construction work force temporarily in an area.

Existing accommodation units are not expected to be adequate to meet the incremental demand resulting from the construction labour force of the Millbank TGS because of the historic high summer occupancy rates and the other ongoing development projects in the immediate area.

With regard to other regional services, it is anticipated that any impacts on the education system in the area will be minimal because there will be few accompanying families. The health care facilities in the area should not be unduly strained. The two local hospitals have surplus capacity and will be able to accommodate the incremental demand from the temporary increase in population in the area. Existing fire protection and police services are adequate to accommodate any additional demand. The sewage resulting from the presence of the labour force on the unserviced construction site could create an environmental or health problem.

Existing fire protection and police services are adequate to accommodate any additional demand. The sewage resutling from the presence of the labour force on the unserviced construction site could create an environmental or health problem.

6.2.6.2 Control Measures

Sewage at the site will be contained in a holding tank and then trucked by private contractor to a private dump site approved by the Department of the Environment.

6.2.7 Tourism

6.2.7.1 Potential Effects

The increased demand for accommodation in the Chatham/Newcastle area could have positive and negative effects on the local hospitality industry:

- the demand from the project work force will provide a continued source of guaranteed short term revenue (most weekly or monthly rentals are at reduced rates);
- some of the demand for accommodations will be in the off-season when occupancy rates are traditionally low;
- most of the rooms will be withdrawn from the lower end of the price range (with less impact on the regular tourist industry except when special events such as the Irish Festival fill all available accommodation in the area);
- large trucks and company vehicles can cause parking problems and potentially lower the image of an establishment; and
- the synthetically high occupancy rates due to construction projects distorts the market and could stimulate unwarranted investment in new units.

6.2.7.1 Control Measures

In order to prevent unwarranted investment in new units, the planning departments in Chatham and Newcastle will be informed of the temporary nature of the accommodation demand resulting from the project.

6.2.7.2 Residual Impacts

The overall short term impact on tourism and the hospitality industry is expected to be positive.

CHAPTER SEVEN

OPERATIONAL PHASE

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7.0 OPERATIONAL PHASE EFFECTS

This Chapter presents the environmental and socioeconomic effects associated with the operational phase of the project. The various effects are considered and presented in the order in which they were first posed as significant issues in the Guidelines which governed the conduct of this EIA. However, the impacts of construction activities have been dealt with separately in Chapter Six above.

7.1 Gaseous Emissions

7.1.1 Modelling Approach

7.1.1.1 Background

The proposed thermal generating station (TGS) at Millbank will consist of four diesel fired turbines, each with a nominal rating of 100 MW. The rating of the units will vary from 88 MW during the summer to 100 MW in the winter. The maximum capacity rating is 105 MW per unit or 420 MW for the station. The rating of the units is equivalent to energy requirements ranging from 978 MBTU per hour during the summer to 1153 MBTU per hour in the winter due to differences in temperature dependent air density. The atmospheric combustion products from the units will be emitted from four 45 m high stacks, placed 30 m apart in a straight line. The combustion products that will be emitted consist of oxides of sulphur, nitrogen and carbon, and particulate matter. The emission rates from the TGS are based on the highest energy requirements, namely 1153 MBTU per hour.

The atmospheric emissions that will be modelled are the oxides of sulphur and nitrogen and particulate matter. These pollutants result from the combustion of fuel in the turbines. The sulphur dioxide (SO_2) emissions are estimated on the basis of total conversion of the sulphur in fuel to sulphur dioxide. In addition, the sulphate species formed as a result of the secondary reactions of SO_2 in the atmosphere are considered in terms of their wet and dry deposition. Nitrogen oxides are produced in the combustion chamber from the high temperature oxidation of nitrogen in air and from the oxidation of smaller amounts of nitrogen compounds in the fuel.

The potential impacts of these emissions on air quality and deposition levels in the airshed are considered in the following chapter. The air quality aspects considered are the ground level concentrations of SO_2, NO_2 and TSP, and deposition levels (wet and total), expressed in terms of annual sulphate deposition (in kg SO_4/ha/y). The significance of the carbon dioxide emissions which are produced in the combustion of the diesel fuels is discussed also.

7.1.1.2 Modelling Methodology

Short term model estimates of the ground level concentrations (GLC) resulting from the proposed TGS and from the existing sources were determined. Short term (one-hour average) model predictions for the SO_2 and NO_2 pollutants were made based on hourly meteorological data from the nearest principal meteorological station at Chatham Airport. Data from the most recent available 5 year period (1984 - 1988) were used in the model predictions. The predicted 1-hour averages were used to estimate annual and running 24-hour averages as required. Estimates of the highest ground level concentration (GLC) for the various averaging periods are compared with the corresponding New Brunswick air quality standards and Canadian National Ambient Air Quality Objectives (NAAQOs).

Long term (annual averages) model estimates of annual total (wet plus dry) and wet sulphate deposition were made based on seasonal meteorological data and annual emissions. The annual deposition values are discussed in terms of their location and comparison with available guidelines for acceptable wet sulphate deposition levels for sensitive soils. Estimates of deposition levels for the winter season were made and were based upon the assumption of only winter operation of the TGS.

7.1.1.3 Emission Sources

Emissions from the proposed TGS are characterized in this section. These emissions, along with those from existing sources, will be considered for inclusion in the modelling of the dispersion of the atmospheric emissions. In addition to the emissions that are vented through a stack on each unit, other potential sources are the fugitive emissions of volatile organic compounds from fuel storage tanks.

Stack Emissions

During the operation of a thermal generating station, a variety of load conditions that lead to a range of stack parameters (SO_2, NO_2 and particulate emission rates, stack exit temperature and velocity) are encountered. The emission rates, the exit velocity, and exit temperature stack parameters for the proposed TGS used in the model predictions were selected at the appropriate end of their ranges of values so that the maximum GLCs were predicted. The emission rates used in the model predictions apply to energy requirements corresponding to the maximum capacity rating of 1153 MBTU/h. The SO_2 emission rate used in the model runs represents the combustion of fuel with a nominal sulphur content of 0.5% which is the maximum sulphur content in the fuel that would be used at the station. The stack parameters for the proposed generating station and the estimated stack emission rates for SO_2, NO_2 and particulates are presented in Table 7-1. Also included in Table 7-1 are emissions data for other sources in the airshed and their corresponding stack parameter data. These values, which were used as inputs to the dispersion model in the calculation of ground level concentrations, will give the most conservative (highest) estimates of ground level concentrations.

The SO_2 emission rate was calculated based on the maximum sulphur content in diesel fuel. This SO_2 emission rate will meet the national emission guidelines for new stationery sources of 0.6 lb SO_2/MBTU.

TABLE 7-1

Summary of Stack Parameter Data For Sources in the Millbank Airshed

Source	Emission Rates			Stack Height	Exit Temperature	Stack Diameter	Exit Velocity
	SO_2	NO_2	Particulates				
Proposed Millbank TGS (Based on 500 h/y)	349 g/s 627.8 t/y	174 g/s 313.9 t/y	58 g/s 104.6 t/y	45 m	496 °C	4.5 m	40 m/s
Chatham TGS unit #3	35 g/s 500 t/y	21 g/s 50 t/y	4 g/s 50 t/y	76 m	170 °C	3.0 m	7 m/s
MPPI [1] #1 Power Boiler	93 g/s 300 t/y	0 0	58.6 g/s 189 t/y^2	68.6 m	110 °C	3.05 m	20.7 m
MPPI Package Boiler	135 g/s 1400 t/y	0 0	0 0	30.48 m	175 °C	2.14 m	17.2 m/s
Hog Fuel Boiler	25 g/s 105 t/y	0 0	2.6 g/s 11 t/y^2	18.3 m	135 °C	1.52 m	9.1 m/s
Flash Dryer cyclones	NA 215 t/y	0 0	0 0	25 m	NA	NA	NA
MPPI #4 Power Boiler	0 0	0 0	6.9 g/s 218 t/y^3	67.8 m	180 °C	2.03 m	6.5 m/s
MPPI #1 Lime Kiln	2.2 g/s 71 t/y^3	0 0	2.3 g/s 71 t/y^3	43.9 m	65 °C	1.07 m	9.4 m/s
MPPI #2 Lime Kiln	0.2 g/s 6.0 t/y^3	0 0	1.8 g/s 57 t/y	43.6 m	60.65 °C	1.52 m	9.1 m/s

[1] MPPI Miramichi Pulp and Paper Industries

[2] Calculated based on g/s emission rates but corrected by the capacity factor derived from SO_2 information provided by N.B. Department of Environment

[3] Calculated based on the g/s emission rates with 100% capacity factor.

The source emissions data used for the model predictions of annual sulphur (or sulphate) deposition levels were based on annually averaged plant emission data for the existing sources. For the proposed TGS, capacity is equivalent to 500 hours. In addition multiples of 500 hours (1000 and 2000 hours) of operation per year were modelled to allow consideration of a variety of circumstances. For example, an annual operating period of 2000 hours is equivalent to the operation of all 500 planned hours in a single season.

The use of these latter two periods of operation is intended as a sensitivity analysis in order to demonstrate the incremental effects of emissions associated with such operations.

Storage Tank Emissions

The potential release of fugitive hydrocarbon emissions into the local airshed is typical of the storage of petroleum products. The winter grade #2 diesel fuel oil which will be used for power generation will be stored on site at Millbank in two 250,000 bbl fixed-roof tanks. The tank dimensions are 60 m in diameter by 15 m in height. Fugitive emissions or evaporative losses associated with fixed-roof storage tanks are breathing losses and working losses.

Breathing losses are due to the release of vapour from a tank through vapour expansion and contraction resulting from changes in temperature and pressure. This loss occurs without any liquid level change in the tank. Working losses are a consequence of filling and emptying the tanks. Filling losses occur when the pressure within the tank exceeds the relief pressure, due to an increase in the tank liquid level, and vapours are emitted into the atmosphere. Emptying losses occur when air is drawn into the tank during liquid removal and becomes saturated with organic vapour and expands.

Breathing losses are a function of molecular weights of compounds in the liquid, their vapour pressure (which is a function of temperature), the tank dimensions, the liquid level within the tank, the exterior colour of the tank (heating due to solar radiation) and daily diurnal temperature change (Joyner, 1986; U.S. EPA, 1985, 1985a, 1988, 1988a). The diurnal temperature change is calculated as the difference between daily maximum and minimum ambient temperatures. Table 7-2 provides a list of the parameters relevant to the determination of breathing losses.

The total quantity of hydrocarbon vapours emitted into the local airshed due to breathing losses are presented in Table 7-3. The variation with respect to season and liquid level within the tank is also shown. As expected, the highest emissions occur during the summer when the temperature change is the greatest. Higher emissions are also associated with low liquid levels since the remaining tank volume is occupied by vapour. The total annual emission rates for both tanks, for 50% capacity, are presented in Table 7-3 also.

The seasonal variation of hydrocarbon emissions due to working losses is also presented in Table 7-3. Working losses are a function of the material mole weight and vapour pressure, tank volume and total annual throughput (Joyner, 1986; U.S. EPA, 1985, 1985a, 1988, 1988a). These losses are an order of magnitude below the breathing losses.

Hydrocarbons are generally innocuous but they do enhance the oxidation rate in the formation of ozone. Table 7-4 provides a chemical profile of organic species which may be found in diesel fuel (U.S. EPA, 1988a). These species can be classified as paraffins or non-reactive Volatile Organic Compounds (VOCs) and are considered to have the lowest reactivity rates in the generation of ozone. Methane, ethane and benzene for example, have negligible photochemical reactivity (Seinfeld, 1975). From Table 7-4, methane, ethane and benzene represent over 50 percent of the total emissions. In view of the low level of emissions, and the composition of the emissions, the contribution of these emissions to ozone formation will be negligible.

TABLE 7-2

Fuel Storage Tank Specifications

Number of Tanks	2
Capacity (bbl)	250,000
Type	Fixed Roof
Diameter (m)	60
Height (m)	15
Colour	Silver Aluminum
Throughput (bbl/y)	372,000
Fuel Type	#2 Fuel oil
Density (kg/L)	1
Molecular weight (kg/kg-mole)	130

	Winter	Spring	Summer	Fall
Vapour Pressure (mb)	0.14	0.21	0.57	0.28
Ambient Temperature (°C)	-8.47	3.07	17.6	7
Diurnal Difference (°C)	-10.2	10.5	12.3	10.2

TABLE 7-3

Hydrocarbon Emissions (t/y) From Fuel Storage Tanks at The Proposed Millbank TGS

	Tank Level	Winter	Spring	Summer	Fall	Annual **
Breathing Losses	25%	0.98*	1.3	2.7	1.5	-
	50%	0.80	1.1	2.2	1.2	1.3
	75%	0.55	0.7	1.5	0.91	-
Working Losses		0.048	0.069	0.18	0.088	0.095

* Calculated equivalent annual rate

** Annual rate weighted by season for 50 percent of tank level

TABLE 7-4

Chemical Profile of Diesel Fuel

Species	% by Weight
Hexane	8.08
Heptane	9.48
Octane	6.99
C-7 cycloparaffin	1.3
C-8 cycloparaffin	0.5
Pentane	4.29
Methane	46.31
Ethane	6.99
Propane	9.48
N-Butane	6.19
Iso-Butane	0.3
Benzene	0.1

The hydrocarbon emissions from the fuel storage tanks must be compared with hydrocarbon emissions from other sources of which the natural sources are the only other sources present in the area. Emissions factors for nonmethane hydrocarbons (NMHC) used by Pierce, et al. (1990) to determine the biogenic hydrocarbon emissions the NMHC emissions in the Millbank area. Forests in the Millbank area are coniferous or mixed coniferous/deciduous. Estimates of NMHC emissions from coniferous and deciduous forests are respectively 27 and 29 t y^{-1} km^{-2}. The hydrocarbon emissions from the duel storage tanks, (1.3 t/y) are very small when compared with nonmethane hydrocarbon (NMHC) emissions form natural sources. The ozone forming potential of the hydrocarbon emissions will therefore be negligible. It should be noted also that because of the high exit temperature and thus plume rise, interaction of the nitrogen oxides emissions from the Millbank turbines with hydrocarbon emissions from the fuel storage tanks will not occur near the source. The ozone forming potential due to emissions near the source will be negligible. At further downwind distances, since the natural NMHC emissions are much larger than those from the Millbank station, the ozone forming potential will be negligible.

The hydrocarbons in diesel fuel include up to 0.1% of benzene - a chemical that is on the Canadian Environmental Protection Act (CEPA) pollutant priority list. The emissions of benzene are small when compared, for example, with emissions from gasoline sources which contain 1 to 3% benzene by weight. Estimates of the ambient concentrations of benzene that occur as a result of fugitive emissions from the storage tanks are difficult to determine. The resulting ambient concentrations are expected to be small in relation to similar emissions from gasoline storage since the benzene content is much lower in diesel fuel.

Carbon Dioxide

Other contaminants which are released into the local environment include CO_2 from the stack.

The combustion sources that emit significant amounts of CO_2 from fossil fuel combustion include power generation, all modes of transportation and residential, commercial and industrial fuel combustion. Carbon dioxide emissions from the production of electricity account for approximately 28 percent of all global anthropogenic CO_2 emissions (Shepard, 1988).

The Millbank TGS is estimated to release 0.15 Mtonne/y of CO_2. This is 2 orders of magnitude below the total provincial emission of 19.4 Mtonne/y which includes utilities, industrial, commercial and residential users, and transportation. On a global scale Canada's anthropogenic emissions are in the order of 500 Mtonnes/y as compared to the estimated world total of 20,000 Mtonnes/y.

7.1.2 Short Term Modelling - Gaseous and Particulate Pollutants

The models used to predict the 1-hour average GLC are the currently proposed Ontario Ministry of the Environment (OME) Regulation 308 (Environment Ontario, 1987) models. The model formulations are considered to be the most advanced models for predicting ground level concentrations under a variety of meteorological conditions (see Venkatram and Wyngaard, 1988). The computer model used in this study incorporates an OME-approved meteorological preprocessor that calculates meteorological parameters, including mixing height and atmospheric stability class (unstable, neutral or stable), for each hour based on meteorological data (hourly surface temperature, surface pressure, wind speed and direction, fraction of cloud cover and snowing indicator, and daily snow depth). The model has been adapted to determine in an efficient manner the ground level concentrations from multiple sources. This adaptation retains all of the original model formulations but deals with the arithmetic of adding the GLC at each grid point. The OME model includes submodels for plume rise under various conditions.

The plume rise submodel utilizes the Briggs (1975) formulations for neutral and stable boundary layers and the Briggs (1984) expression for unstable situations. Because the stacks for the proposed Millbank TGS are relatively close to each other (30 m apart, in a straight line), the potential for interaction between plumes from each stack was considered. The interaction, which will affect the plume rise, is dependent on source geometry and wind direction (MEP, 1979; Briggs, 1974). Enhancement of the plume rise will lead to better dispersion and thus lower ground level concentration. The potential for interaction increases when the stacks are closer to each other. For stacks that are colinear, the interaction depends on the wind direction and is greatest when the wind is aligned with the stacks and is least for winds that are perpendicular to the alignment of the stacks. It was also found that the maximum predicted GLC showed little difference (< 2 percent) between treating the stacks as separate (without plume interaction), or combined into a single effective stack. The effective combined stack gives the higher (by 2%) concentration. Neglect of plume enhancement will result in lower plume rise and thus higher (i.e., conservative) predicted ground level concentrations. A conservative approach, in which plume interaction was neglected and the stacks were combined into a single equivalent stack, was adopted. The model predictions used in this study therefore will be higher (i.e., conservative) than if plume interaction and separate stacks had been considered.

The modelling approach adopted was to determine the maximum predicted one hour average SO_2 and NO_2 concentrations, and the maximum predicted 24-hour and annual average TSP, SO_2 and NO_2 concentrations; and their locations for each running 24 hour period. Since the proposed TGS is more likely to be operated during selected times of the day (6 to 11 a.m. and 4 to 9 p.m.), than at other times, the maximum concentration for each hour of the day was determined. These maxima were determined for the proposed TGS alone as well as for the combined sources. In all cases, the predicted concentrations utilized meteorological data collected at Chatham airport for each hour in the five year period 1984 to 1988. The fundamental assumption of this approach is that over such a period, the worst case meteorological conditions that would give rise to the highest GLCs would occur. The locations at which these maximum concentrations occurred were examined in relation to the location of potentially sensitive receptors in order to select "special receptor" locations at which more detailed model predictions would be obtained.

The model runs at the special receptor locations provided information on the maximum hourly and 24-hour average concentrations, and their frequency distributions. The predictions were based on emissions from the proposed TGS alone, and from the combined sources (proposed TGS, existing sources). Downwind profiles were prepared for the SO_2 and NO_2 concentrations associated with meteorological conditions for the hour with the maximum predicted GLC.

7.1.2.1 Maximum Predicted Ground Level Concentrations

Table 7-5 lists the maximum predicted 1-hour, 24-hour and annual average SO_2 and NO_2 concentrations and the 24-hour and annual average TSP concentrations (and their respective locations), due to emissions from the proposed TGS alone. A similar tabulation is given in Table 7-6 for the combined sources in the airshed.

7.1.2.2 Maximum Predicted Concentrations Due to the Proposed Millbank TGS Alone

The maximum predicted 1-hour, 24-hour and annual average GLCs are respectively, 232, 52 and 0.06 $\mu g\ m^{-3}$ in the case of SO_2 and 116, 26 and 0.03 $\mu g\ m^{-3}$ respectively in the case of NO_2. The maximum predicted 24-hour and annual average GLCs for TSP are respectively 9 and 0.01 $\mu g\ m^{-3}$. These maximum predicted SO_2 and NO_2 GLCs due to the proposed Millbank TGS alone are all well below the relevant New Brunswick air quality standards, which are numerically equal to the Canadian National Ambient Air Quality Objective levels. Table 7-7 lists the air quality standards for New Brunswick and the Canadian National Air Quality Objectives. The Millbank TGS will therefore have negligible impact on ambient air quality.

TABLE 7-5

Maximum Predicted SO_2, NO_2 and TSP Concentrations and Their Locations Due to The Proposed Millbank TGS

Pollutant	Averaging Period	Maximum Predicted GLC $\mu g\ m^{-3}$	Location[1]	
			x	y
SO_2	1 h	232	2.1	-0.5
	24 h	52	-2.1	-1.7
	1 year[2]	0.06	5.0	2.0
NO_2	1 h	116	2.1	-0.5
	24 h	26	-2.1	-1.7
	1 year[2]	0.03	5.0	2.0
TSP	24 h	9	-2.1	-1.7
	1 year[2]	0.01	5.0	2.0

[1] Relative to the stacks at the proposed Millbank TGS.

Distances x and y are in km from the stack at the proposed Millbank TGS as determined by wind directions during which predictions occur. Selected locations are shown on Figure 7-2 as A and C.

[2] Based on 500 hours of operation per year. Annual means for 1000 or 2000 hours per year would be proportionally higher.

TABLE 7-6

Maximum Predicted SO_2, NO_2 and TSP Concentrations and Their Locations Due to the Combined Sources in the Millbank Airshed*

Pollutant	Averaging Period	Maximum Predicted GLC $\mu g\ m^{-3}$	Location**	
			x	y
SO_2	1 h	858	-10.5	-11.2
	24 h	385	-12.2	-11.9
	1 year	3.1	-10.0	-12.0
NO_2	1 h	116	2.1	-0.5
	24 h	26	-2.1	-1.7
	1 year	0.06	1.0	-3.0
TSP	24 h	36	-12.9	-12.5
	1 year	2.1	-10.0	-11.0

* Does not include sources under construction

** Relative to the stacks at the proposed Millbank TGS.

Distances x and y are in km from the stack at the proposed Millbank TGS. Selected locations are shown on Figure 7-2 as C, D and E.

TABLE 7-7

New Brunswick Air Quality Standards and Canadian Air Quality Objectives (concentrations in $\mu g/m^3$)

	Pollutant								
	SO_2			NO_x			Particulates		
	1-h	24-h	1-y	1-h	24-h	1-y	1-h	24-h	1-y[1]
N.B. Standards	900	300	60	400	200	100	-	120	70
National Objectives									
Max. Desirable	450	150	30	-	-	60	-	-	60
Max. Acceptable	900	300	60	400	200	100	-	120	70
Max. Tolerable	-	800	-	1000	-	-	-	400	-

[1] Geometric mean.

7.1.2.3 Downwind Profiles

The variation of the predicted GLCs at distances directly downwind of sources provides a convenient indication of the dispersion of the plume in the downwind direction. Downwind profiles for the maximum predicted SO_2 ground level concentrations due to emissions from the proposed TGS alone are illustrated in Figure 7-1. The profiles were determined in special model runs in which concentrations were predicted only at special receptors namely, at varying downwind distances (close together near the stack), and up to 40 km from the stack. The meteorological conditions used to predict the profiles are for the hour when the maximum GLC is predicted to occur.

7.1.2.4 Predicted GLCs From The Combined Sources

The GLCs due to the combined sources, namely, the proposed Millbank TGS and the existing sources, were determined for the entire grid.

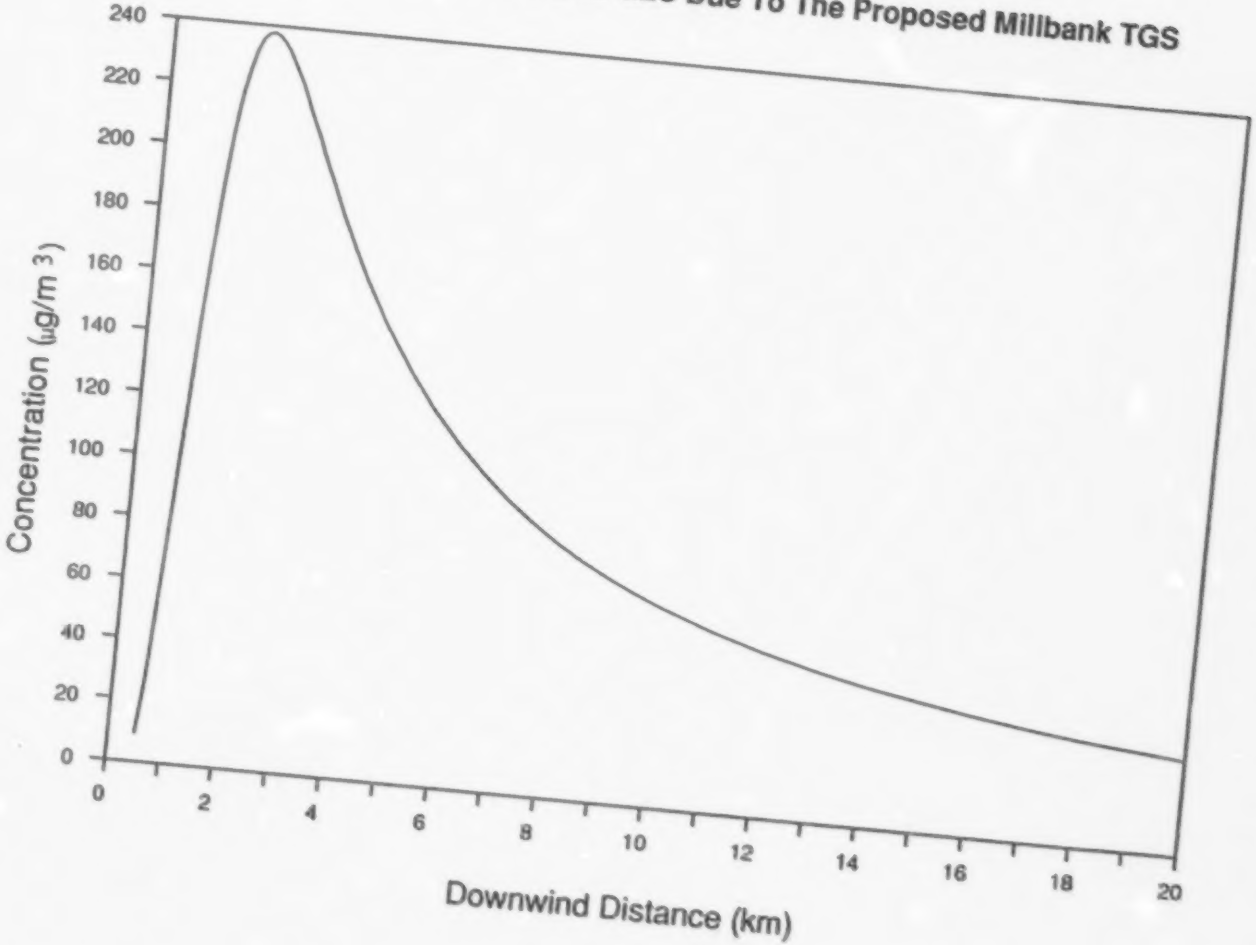
The maximum predicted 1-hour, 24-hour and annual average GLCs are respectively, 858, 385 and 3.1 $\mu g\ m^{-3}$ in the case of SO_2 and 116, 26 and 0.06 $\mu g\ m^{-3}$ respectively in the case of NO_2. The maximum predicted 24-hour and annual average GLCs for TSP are respectively 36 and 2.1 $\mu g\ m^{-3}$. These maximum predicted concentrations and their locations are listed in Table 7-6. The maximum predicted 24-hour GLC due to the combined sources does exceed the New Brunswick standard for the 24-hour average SO_2 concentration. The proposed Millbank TGS does not contribute at all to the GLC at this location.

The maximum predicted NO_2 concentrations (1-hour and 24-hour average concentrations) and their respective locations, due to emissions from the combined sources, are the same as those due to the proposed TGS alone.

FIGURE 7-1

Downwind Concentration Profile

For The Maximum Predicted SO2 GLC Due To The Proposed Millbank TGS



7.1.2.5 Detailed Model Predictions at Special Receptor Locations

The maximum predicted concentrations due to the proposed TGS alone and also due to the combined sources were determined for each hour of the day over the entire grid. Thus 24 maximum values were obtained. The locations of the resulting 24 maximum hourly values were obtained also. These locations as well as the locations at which the maximum 24-hour average concentrations due to the proposed TGS alone and due to the combined sources were considered for use as special receptor locations at which more detailed model runs would be conducted. The times of day when the proposed TGS is most likely to be in operation (6 to 11 a.m. and 4 to 9 p.m.) were taken into account in making the selection.

Five locations were selected as follows:

Receptor A) the maximum predicted 1-hour average SO_2 GLC due to the proposed TGS alone (same as the maximum combined 1 hour average NO_2 as indicated on Table 7-5);

Receptor B) the maximum predicted 1-hour average SO_2 GLC between 6 and 11 a.m. due to the proposed TGS alone (not indicated on Table 7-5 or Table 7-6);

Receptor C) the maximum predicted 1-hour average SO_2 GLC due to the proposed TGS alone between 4 and 9 p.m. (same as the 24 hour average SO_2 due to the proposed TGS alone as indicated on Table 7-5, and to the NO_x 24-hour average NO_2 concentrations due to the combined sources as indicated on Table 7-6);

Receptor D) the maximum predicted 1-hour average SO_2 GLC due to the combined sources (same location between 6 and 11 a.m. and between 4 and 9 p.m., and indicated on Table 7-6), and

Receptor E) the maximum predicted 24-hour average SO_2 GLC due to the combined sources (as indicated on Table 7-6).

Model predictions for a five year period were made at these locations to determine the concentrations due to each source. Frequency distributions of the 1-hour and 24-hour average SO_2 concentrations due to the proposed TGS alone and due to the combined sources were made at four of these locations: A, B, D and E above. The location specified in C was omitted from detailed analysis since the maximum predicted concentration was so low (165 $\mu g\ m^{-3}$) and the concentrations would fall in only two of the concentration ranges.

The frequency distributions of the 1-hour average SO_2 concentrations at the locations of the maximum predicted concentrations due to the proposed TGS alone and the combined sources are listed in Table 7-8. Similar tabulations for the distributions of the 24-hour average concentrations at the locations where the maximum predicted 24-hour average concentrations due to the TGS alone and the combined sources are listed in Table 7-9.

The predicted SO_2 concentrations due to the proposed Millbank TGS are well below the range of (50 percent of the standard for the 1-hour average SO_2 concentration) where supplementary control measures would be considered.

The proposed Millbank TGS makes no contribution to the GLC at the location where the maximum 1 hour and 24 hour average concentrations due to the combined sources occur. The frequency distribution in Table 7-9 shows that in five years only 12 occasions are predicted when the 24-hour average would exceed the Provincial standard. Monitoring activities in the vicinities of the existing sources currently include total reduced sulphur measurements. Efforts are underway to reduce the emissions from some of the existing sources in the Newcastle area.

Special receptor locations D and E, at which detailed model estimates of ground level concentrations were made, are not near to any of the vegetative or terrestrial receptors that were identified (Figure 7-2). Special receptor locations A, B, and C are at least 200

TABLE 7-8

Five Year Frequency Distributions Of The 1-hour Average SO2 Concentrations At The Locations Of The Maximum Predicted Concentrations Due To The Proposed TGS Alone And The Combined Sources

Concentration Range $\mu g\ m^{-3}$	Proposed Millbank TGS	Combined Sources
≤100	43845	41884
100 - ≤200	2	828
200 - ≤300	1	577
300 - ≤400	0	328
400 - ≤450		52
450 - ≤900		179
>900		0

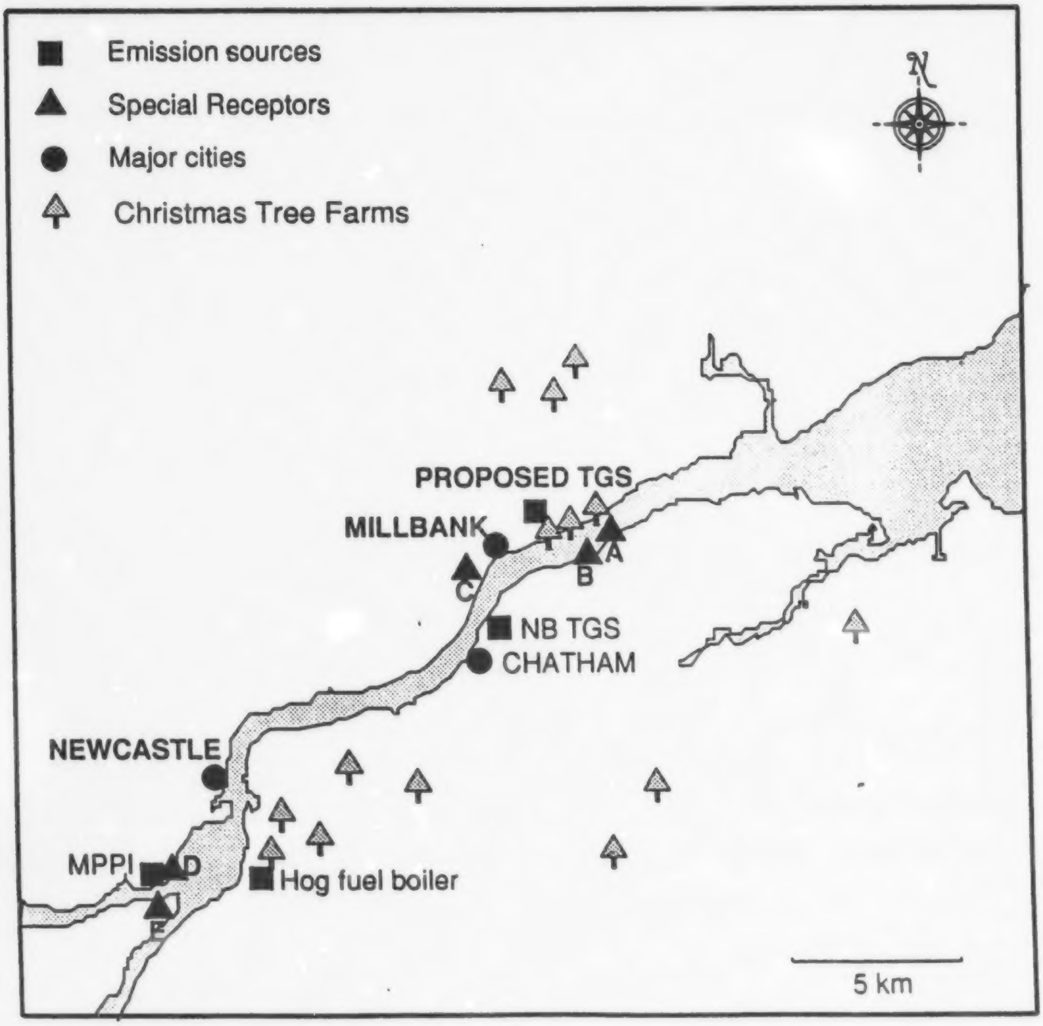
TABLE 7-9

Five Year Frequency Distributions Of The 24-hour Average SO_2 Concentrations At The Locations Of The Maximum Predicted Concentrations Due To The Proposed TGS Alone And The Combined Sources

Concentration Range $\mu g\ m^{-3}$	Proposed Millbank TGS	Combined Sources
≤100	43825	43406
100 - ≤200	0	332
200 - ≤300		75
300 - ≤400		12
400 - ≤450		0
450 - ≤900		
>900		

FIGURE 7-2

The Emission Sources and The Selected Receptors in the Millbank Airshed


■ Emission sources
▲ Special Receptors
● Major cities
△ Christmas Tree Farms
N
PROPOSED TGS
MILLBANK
A
B
C
NB TGS
CHATHAM
NEWCASTLE
MPPI
D
E
Hog fuel boiler
5 km

m from the sensitive Christmas tree areas. The maximum concentration at the special receptors are below the level where potential impacts occur.

The maximum predicted SO_2, NO_2 and TSP concentrations due to the proposed Millbank TGS are below all relevant Provincial air quality standards. The provincial standards are numerically equal to the corresponding maximum acceptable air quality objectives. The maximum acceptable air quality objectives are designed to provide adequate protection against effects of pollutants on vegetation, soil, animals, visibility, personal comfort and well being. It should be noted that the maximum tolerable objective levels, which are higher than the maximum acceptable objective levels, denote concentrations above which appropriate action is required to protect human health. The predicted ground level concentrations due to the proposed Millbank TGS clearly are below the maximum acceptable objectives and thus will not pose any threat to human health.

7.1.2.6 Other Impacts

The potential effects of the proposed Millbank TGS during periods of fog and the potential of the emissions to cause acid misting or acid fog are examined in this section.

The incidence of fog in the Chatham area was shown to be highest between the months of April and November. During the winter months, when the proposed Millbank TGS is most likely to be operating, the incidence of fog is lowest. In addition, interaction of the plume from the proposed Millbank TGS with fog is not likely since the stack gases are emitted at a very high temperature (496°C) and thus the plume rise will be such that it will be above the surface level fog. The high temperature of the exit gases will render the plume invisible since considerable cooling would have to take place before reaching the dew point of the ambient atmosphere. A highly visible plume due to condensation of water vapour is therefore unlikely.

7.1.3 Long Term (Wet Deposition) Modelling

7.1.3.1 Modelling Approach

Estimates of the annual mean wet and total sulphate deposition in the airshed were determined for three situations, namely:

- the existing sources;
- the proposed TGS alone; and
- the combined emissions of the existing and the proposed TGS sources.

In the latter two cases, the predictions were based on TGS emissions equivalent to 500 and 2000 hours of operation per year. Lower multiples of the nominal capacity factor of 500 hours (i.e., equivalent to 1000 and 1500 hours operation per year) for the TGS were not used because of the very low deposition levels due to the proposed TGS.

A multiple source model, the Alberta Deposition Model with Terrain (ADEPT) (Alberta Environment, 1987), which is used for regulatory purposes in Alberta, was used to estimate the wet and dry deposition levels. A description of the model, its application in the present case, the input data used, and the modelling results follow.

7.1.3.2 Model Description

The ADEPT model was used for predicting long-term (annual) deposition of sulphur. This model is the most recent update to the SULDEP2 (Alberta Environment, 1984) model originally developed for Alberta Environment. ADEPT is a multiple source model which has replaced the previous single source SULDEP2. ADEPT is presently maintained and recommended for regulatory use in Alberta by Alberta Environment.

ADEPT models dry deposition by the simple "deposition velocity" approach, which is presently the commonly used modelling technique (see, for example, Shieh et al., 1979). The features of the model include:

- complex terrain effects;
- surface roughness influences in the dispersion parameters formulation and wind speed equations;
- variable wind speed with height in plume rise and dispersion formulations;
- the effect of mixing height on plume rise and vertical dispersion;
- the use of the total STAR data set;
- an estimate of annual sulphur deposition as a percentage of the sulphur emission within specified radial distances from the source, and
- optional use of a precipitation wind rose.

The model does not include chemical transformation of SO_2 to sulphate. Estimates from this model should be viewed in terms of the relative sulphate deposition levels predicted for the existing and proposed sources in the Millbank area.

The ADEPT model was used to generate predicted annual sulphur deposition for an area of 100 km in an east-west direction and 80 km in a north-south direction centred approximately on the proposed TGS stacks. The model outputs include wet and total sulphur depositions at grid points with a 0.1 km resolution, for each source and for all sources combined. The sulphur deposition initially output by the model has been converted to sulphate deposition by multiplying the sulphur deposition by three (the ratio of the molecular weights of sulphate to sulphur).

7.1.3.3 Model Inputs

Meteorological Input Data for ADEPT

The meteorological inputs to ADEPT consist of: the joint frequency distribution of wind speed, wind direction and Pasquill stability class, which are the standard output from the STAR analysis. The STAR data derived from Chatham Airport observations were obtained from the Digital Archive at the Canadian Climate Centre for a 10 year span (1979-1988) on a seasonal basis. Also required by ADEPT are: the mean daily ambient temperature, the mean seasonal precipitation rate, the fraction of time that precipitation occurs each season, seasonal SO_2 dry deposition velocities, and the background pH in rainwater. The model input data (except for the STAR data set) are presented in Table 7-10.

Source Input Data for ADEPT

The relevant input data for stack sources are: sulphur dioxide emission rate, total gas flow rate (at 101.325 kPa), stack height, stack diameter, and the stack gas exit temperature. These parameters also appear in Table 7-10. The total gas flow rate (m^3/s) was obtained by multiplying the stack exit gas velocity (m/s) by the stack cross-sectional area (m^2). Annual capacity factors equivalent to 500 and 2000 hours of operation per year were used for the emission rate for the proposed TGS.

7.1.3.4 Background Deposition Levels

Sulphur and nitrogen oxides which are initially emitted from the combustion of fossil fuels are transformed in the atmosphere into secondary pollutants such as sulphate and nitrate species. These species, together with gaseous sulphur oxides, can be removed from the

TABLE 7-10

TYPICAL INPUTS FOR ADEPT MODEL RUNS

```
      TITLE: MILLBANK AREA - 5 SOURCES
      STACK CONVERSION OPTIONS:
          INPUT VOL. FLOWRATE IN                M3S-1
          REF TEMP IN                           DEG C
          MASS FLOW RATE IN                     TONNES/D
          STACK TEMPERATURE IN                  DEG C
          STACK DIAMETER IN                     M
          STACK HEIGHT IN                       M

      METEOROLOGICAL DATA CONVERSION OPTIONS:
          PRECIPITATION IN                      MMHR-1
          MEAN MAXIMUM MIXING HEIGHT IN         M
          MEAN SEASONAL TEMPERATURE IN          DEG C
          DEPOSITION VELOCITY IN                MS-1

      OTHER CONVERSION OPTIONS:
          SOURCE DISTANCES IN                   KM
          TERRAIN ELEVATIONS IN                 M
          TERRAIN GRID POINT INCREMENTS IN      KM
          WINDOW COORDINATES IN                 KM

      PLANT PARAMETERS:
        SOURCE NUMBER  1: PROPOSED MILLBANK TGS STACK
          LOCATION OF SOURCE               =      .0 KM  NORTH  AND
                                                   .0  KM    EAST  OF
ORIGIN
          STACK BASE ELEVATION             =   30.   M
          STACK EXIT FLOW RATE
            AT REFERENCE TEMP AND 101.3KPA =  636.2  M3S-1
          REFERENCE TEMPERATURE            =  15.0   DEG C
          CONTAMINANT EMISSION RATE        =   1.7   TONNES/D SO2

          STACK TEMPERATURE                =  496.   DEG C
          STACK DIAMETER                   =   4.5   M
          STACK HEIGHT                     =  45.0   M

        SOURCE NUMBER  2: MIRAMICHI PULP & PAPER #1 POWER BOILER
STACK
          LOCATION OF SOURCE               =   -11.2 KM  NORTH  AND
                                               -11.2  KM    EAST  OF
ORIGIN
          STACK BASE ELEVATION             =   30.   M
          STACK EXIT FLOW RATE
            AT REFERENCE TEMP AND 101.3KPA =  151.2  M3S-1
          REFERENCE TEMPERATURE            =  15.0   DEG C
          CONTAMINANT EMISSION RATE        =    .8   TONNES/D SO2

          STACK TEMPERATURE                =  110.   DEG C
          STACK DIAMETER                   =   3.0   M
          STACK HEIGHT                     =  68.6   M
```

TABLE 7-10 (cont'd)

TYPICAL INPUTS FOR ADEPT MODEL RUNS

SOURCE NUMBER 3: MIRAMICHI PULP & PAPER PACKAGE BOILER STACK
LOCATION OF SOURCE = -11.2 KM NORTH AND
-11.2 KM EAST OF ORIGIN
STACK BASE ELEVATION = 30. M
STACK EXIT FLOW RATE
AT REFERENCE TEMP AND 101.3KPA = 61.9 M3S-1
REFERENCE TEMPERATURE = 15.0 DEG C
CONTAMINANT EMISSION RATE = 3.8 TONNES/D SO2
STACK TEMPERATURE = 175. DEG C
STACK DIAMETER = 2.1 M
STACK HEIGHT = 30.5 M

```
      SOURCE NUMBER  4: HOG FUEL BOILER STACK
        LOCATION OF SOURCE                 =   -8.2 KM  NORTH  AND
                                               -10.9 KM   EAST  OF
ORIGIN
        STACK BASE ELEVATION               =   30.   M
        STACK EXIT FLOW RATE
          AT REFERENCE TEMP AND 101.3KPA =   16.6  M3S-1
        REFERENCE TEMPERATURE              =  15.0  DEG C
        CONTAMINANT EMISSION RATE          =    .3  TONNES/D SO2

        STACK TEMPERATURE                  =  135.  DEG C
        STACK DIAMETER                     =   1.5  M
        STACK HEIGHT                       =  18.3  M

      SOURCE NUMBER  5: NB POWER CHATHAM UNIT 3 STACK
        LOCATION OF SOURCE                =   -0.88 KM  NORTH  AND
                                                3.5 KM   EAST  OF
ORIGIN
        STACK BASE ELEVATION               =   30.   M
        STACK EXIT FLOW RATE
          AT REFERENCE TEMP AND 101.3KPA =   49.5  M3S-1
        REFERENCE TEMPERATURE              =  15.0  DEG C
        CONTAMINANT EMISSION RATE          =   1.4  TONNES/D SO2

        STACK TEMPERATURE                  =  170.  DEG C
        STACK DIAMETER                     =   3.0  M
        STACK HEIGHT                       =  76.0  M

    SEASONAL MEAN TEMPERATURE:
         WINTER :   -8.5 DEC C
         SPRING :    3.1 DEC C
         SUMMER :   17.6 DEC C
         AUTUMN :    7.0 DEC C

    PRECIPITATION:
         DJF  .2780 MMHR-1
         MAM  .2810 MMHR-1
         JJA  .2740 MMHR-1
         SON  .3100 MMHR-1
```

TABLE 7-10 (Cont'd)

TYPICAL INPUTS FOR ADEPT MODEL RUNS

DEPOSITION VELOCITIES:
  STABILITY CODE A = .020 MS-1
  STABILITY CODE B = .016 MS-1
  STABILITY CODE C = .014 MS-1
  STABILITY CODE D = .008 MS-1
  STABILITY CODE E = .008 MS-1
  STABILITY CODE F = .002 MS-1

MEAN MAXIMUM MIXING HEIGHTS:
  WINTER : 523.0 M
  SPRING : 893.0 M
  SUMMER : 844.0 M
  AUTUMN : 683.0 M

TIME FACTORS FOR PRECIPITATION:
  WINTER : .489E+00
  SPRING : .424E+00
  SUMMER : .424E+00
  AUTUMN : .418E+00

```
POTENTIAL TEMPERATURE GRADIENT STABILITY E  .020 C/M
POTENTIAL TEMPERATURE GRADIENT STABILITY F  .040 C/M
PLUME RISE CONSTANT 1 1.600
PLUME RISE CONSTANT 2 2.400
ROUGHNESS CLASS:   3
BACKGROUND PH:  4.4

 GRID MAP WINDOW COORDINATES:
     LOWER LEFT CORNER  = ( -50.0, -50.0)
     UPPER LEFT CORNER  = ( -50.0,  50.0)
     UPPER RIGHT CORNER = (  50.0,  50.0)
     LOWER RIGHT CORNER = (  50.0, -50.0)

 TERRAIN ELEVATIONS:
     GRID COORDINATES IN KM
     ELEVATIONS IN M
     THE SIZE OF THE TERRAIN GRID IS 21 BY 21
```

TABLE 7-10 (Cont'd)

TYPICAL INPUTS FOR ADEPT MODEL RUNS

```
                -100.        -90.        -80.        -70.        -60.        -50.        -40.        -30.
        +-----------------------------------------------------------------------------------------------------
   100. !       183.        183.         15.         91.         61.          0.          0.          0.
    90. !       274.        305.        213.        198.        274.         91.         61.         61.
    80. !       274.        305.        396.        427.        320.        122.        244.        152.
    70. !       274.        366.        244.        335.        274.        274.        274.         15.
    60. !       335.        335.        305.        396.        427.        244.        274.        183.
    50. !       518.        396.        274.        457.        457.        305.        274.        198.
    40. !       366.        457.        457.        518.        518.        244.        274.        152.
    30. !       610.        518.        518.        518.        396.        366.        274.        152.
    20. !       579.        640.        427.        427.        427.        335.        213.        122.
    10. !       335.        396.        427.        488.        366.        274.        122.         61.
     0. !       549.        366.        335.        427.        274.        213.        152.         30.
   -10. !       488.        366.        335.        366.        259.        213.        183.         15.
   -20. !       488.        457.        427.        335.        274.        213.         61.         61.
   -30. !       488.        335.        335.        244.        152.        122.         61.         91.
   -40. !       305.        457.        274.        274.        152.        122.         61.         61.
   -50. !       427.        198.        213.        213.        122.        107.         61.         61.
   -60. !       305.        274.        213.        122.        122.         61.        122.         61.
   -70. !       274.        244.        152.        152.        152.        122.         76.         91.
   -80. !       183.        152.        122.        152.        122.        152.        122.         61.
   -90. !       213.        183.        122.        122.        152.        152.         91.         30.
  -100. !       274.        152.        122.        152.        122.        122.         91.         30.
```

```
                 -20.        -10.          0.         10.         20.         30.         40.         50.
        +-----------------------------------------------------------------------------------------------------
   100. !         0.          0.          0.          0.          0.          0.          0.          0.
    90. !        91.          0.          0.          0.          0.          0.          0.          0.
    80. !        30.          0.          0.          0.         15.         15.          0.          0.
    70. !        30.          0.          0.         30.         30.         15.         15.          0.
    60. !        46.          0.         61.         91.         61.         30.         30.          0.
    50. !        91.         61.        152.         91.         61.         30.          0.          0.
    40. !        91.         91.        152.        122.         61.         30.          0.          0.
    30. !        91.        122.        122.         91.         61.         30.          0.          0.
    20. !       107.        122.        122.         61.         61.          0.          0.          0.
    10. !       122.         91.         91.         30.          0.          0.          0.          0.
     0. !       122.         91.         30.          0.          0.         15.         15.          0.
   -10. !        15.         46.         30.         30.         15.         15.         15.          0.
   -20. !        61.         30.         30.         61.         30.         15.         15.          0.
   -30. !        30.         61.         61.         61.         30.         15.         15.          0.
   -40. !        61.         30.         61.         91.         30.         30.          0.          0.
   -50. !        61.         61.         91.         61.         30.         30.          0.         30.
   -60. !       122.         91.         91.         61.         30.         61.         30.         30.
   -70. !        91.         61.         61.         61.         61.         61.         61.          0.
   -80. !        30.         30.         61.         91.         61.         61.         61.         30.
   -90. !        91.        122.         91.         91.         61.         91.         91.         61.
  -100. !        61.         61.         76.         61.         91.         91.        122.         61.
```

TABLE 7-10 (Cont'd)

TYPICAL INPUTS FOR ADEPT MODEL RUNS

	60.	70.	80.	90.	100.
100.	0.	0.	0.	0.	0.
90.	0.	0.	0.	0.	0.
80.	0.	0.	0.	0.	0.
70.	0.	0.	0.	0.	0.
60.	0.	0.	0.	0.	0.
50.	0.	0.	0.	0.	0.
40.	0.	0.	0.	0.	0.
30.	0.	0.	0.	0.	0.
20.	0.	0.	0.	0.	0.
10.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
-10.	0.	0.	0.	0.	0.
-20.	0.	0.	0.	0.	30.
-30.	0.	0.	0.	15.	30.
-40.	0.	0.	15.	30.	15.
-50.	0.	0.	0.	0.	15.
-60.	0.	0.	0.	0.	0.
-70.	15.	0.	0.	0.	0.
-80.	15.	0.	0.	0.	0.
-90.	15.	0.	0.	0.	0.
-100.	30.	15.	15.	30.	0.

atmosphere in precipitation. In the course of the transformation, the pollutants can travel long distances before deposition takes place. A consequence of the long range transport of acidic pollutants is the relatively high background wet deposition levels in areas that are far downwind of major emission sources. The province of New Brunswick, for example, receives long range transported emissions from the eastern U.S. as well as from Quebec and Ontario sources. Background levels of wet deposition therefore will be affected by reductions in emissions from distant sources.

Reductions in SO_2 emissions from Canadian sources have been targeted for 1994 and will amount to a 50% reduction in emissions. Reductions in the U.S. have been announced with reductions of 50% (approximately 10 million tonnes) being considered. Firm commitments of the level and nature of the U.S. reductions remain to be determined. Estimates of the impacts of the Canadian reductions with and without the assumed U.S. reductions and for the base situation using 1980 emissions have been made (OME, 1989). The Ontario Ministry of the Environment Lagrangian puff model was used for these predictions. The model predictions, which include an assumed background of 6 kg SO_4/ha/y, show that the 16.9 kg SO_4/ha/y predicted to occur in New Brunswick is reduced to 15.0 kg SO_4/ha/y when only the Canadian reductions are assumed. Within New Brunswick, the predicted wet deposition when both Canadian and an assumed 50 percent U.S. emission reductions take place is reduced from 16.9 kg SO_4/ha/y in 1980 to 12.9 kg SO_4/ha/y.

The model predictions suggest that reductions in background sulphate deposition levels of about 1.9 kg SO_4/ha/y can be expected from Canadian initiatives in 1994 and a total of 4.0 kg SO_4/ha/y from the combined Canadian and the assumed U.S. initiatives. Recent wet deposition levels in northern New Brunswick are in the range of 9.9 to 15.9 kg SO_4/ha/y with the middle of the range (12.9 kg SO_4/ha/y) selected as the existing background level (Washburn and Gillis et al., 1989). The background sulphate level may be taken to be 1.9 kg SO_4/ha/y lower than the middle of the measured range, or 11 kg SO_4/ha/y, for the period after the Canadian SO_2 reductions come into effect. When the effects of the assumed U.S. emissions reductions take effect, background levels of 8.9 kg SO_4/ha/y in the Millbank area would be appropriate.

7.1.3.5 Model Results - Existing Sources

Model results for the existing and the future conditions in the domain will establish the relative impacts due to the proposed TGS and allow comparisons between existing and future conditions to be made. The annual SO_2 emissions due to each source in the airshed, the percentage of wet and total deposition due to each source, and information on the maximum deposition due to each source and to the combined sources with 500, 1000, and 2000 hours per year of operation for the proposed Millbank TGS, are listed in Tables 7-11 to 7-13 respectively.

Estimates of the deposition due to the existing sources in the airshed are illustrated in Figure 7-3. A background of 12.9 kg SO_4/ha/y is included in the deposition pattern in Figure 7-3. The maximum wet deposition due to the existing sources is 13.4 kg SO_4/ha/y - an increment of only 0.5 kg SO_4/ha/y above the background. The very small amount of SO_2 emissions means that wet deposition levels are negligible. The airshed has a very small area with soils of high sensitivity to acid deposition. These areas are located to the north west of the proposed TGS where the incremental deposition levels due to existing sources are predicted to be 0.02 kg SO_4/ha/y or less (Figure 7-3).

7.1.3.6 Model Predictions - Proposed TGS Alone

The annual wet deposition due to the proposed TGS alone is illustrated in Figures 7-4 and 7-5 for respective capacity factors equivalent to 500 and 2000 hours of operation. The resulting wet deposition levels for 500 hours of operation per year are very small - a maximum of 0.01 kg SO_4/ha/y some 29.2 km E of the proposed TGS stack. At 2000 hours per year, the maximum predicted wet deposition is 0.02 kg SO_4/ha/y at the same

FIGURE 7-3

Wet Annual Sulphate Deposition (kg SO4/ha/y) From The Existing Sources In The Airshed

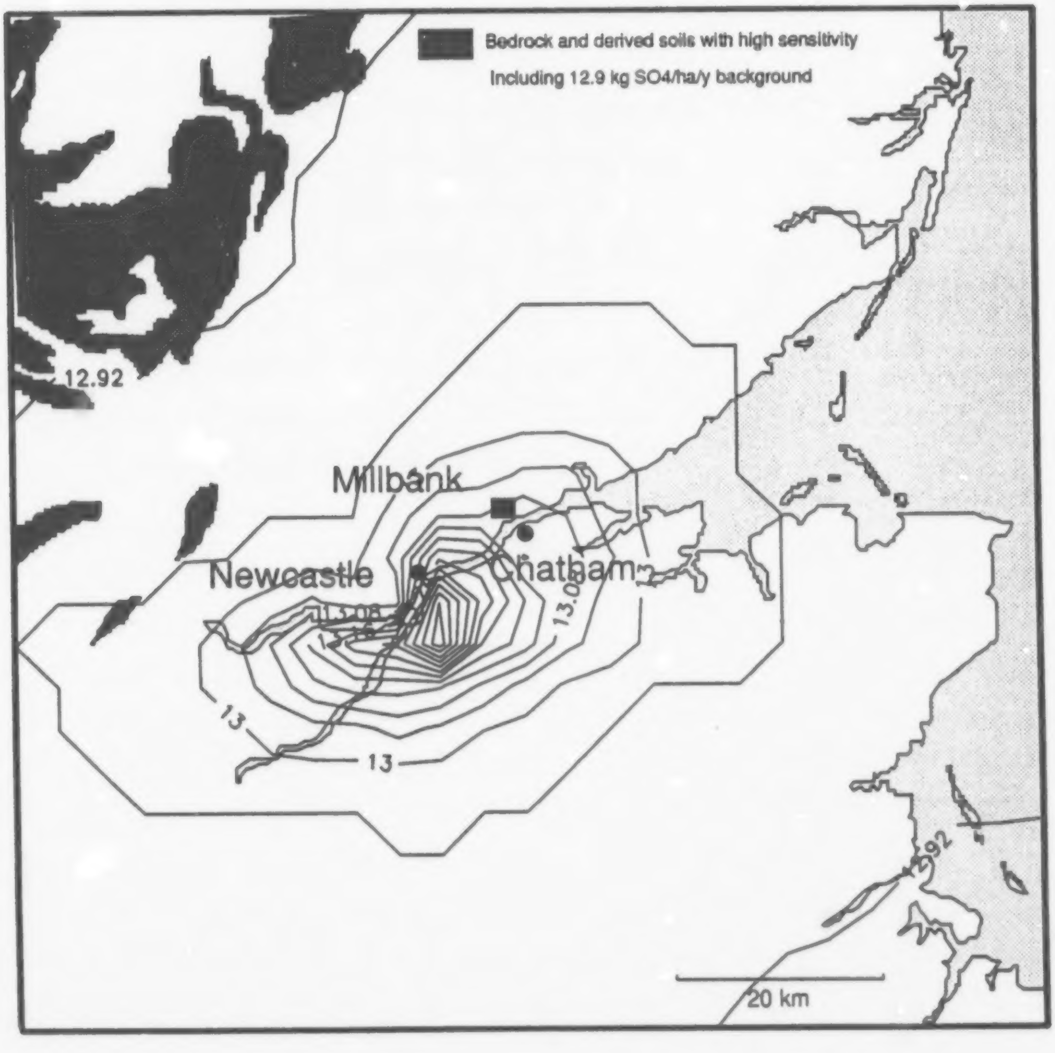

Bedrock and derived soils with high sensitivity
Including 12.9 kg SO4/ha/y background
12.92
Millbank
Newcastle
Chatham
13.08
13.08
13
13
12.92
20 km

FIGURE 7-4

Wet Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
And The Existing Sources In The Airshed
(Annual capacity factor equivalent to 500 hours of operation)

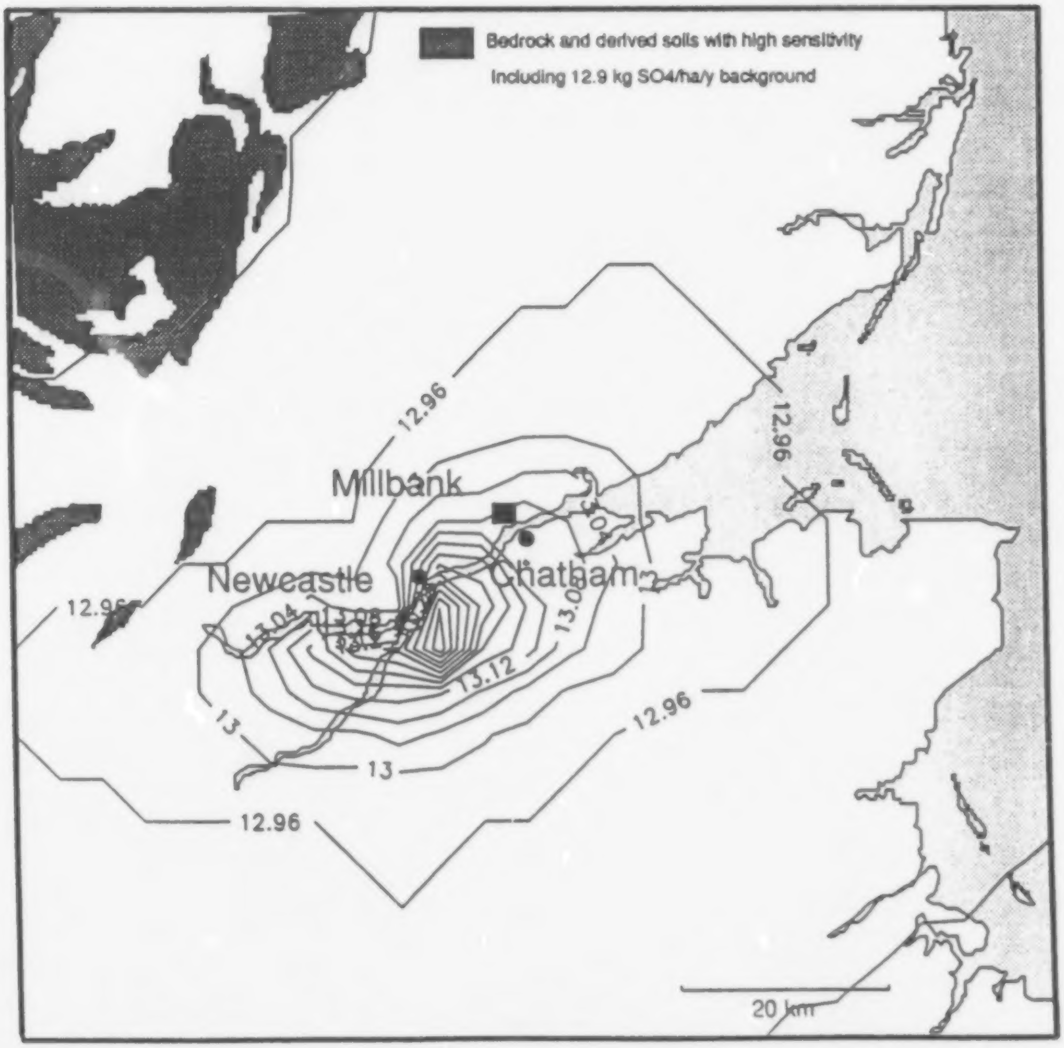
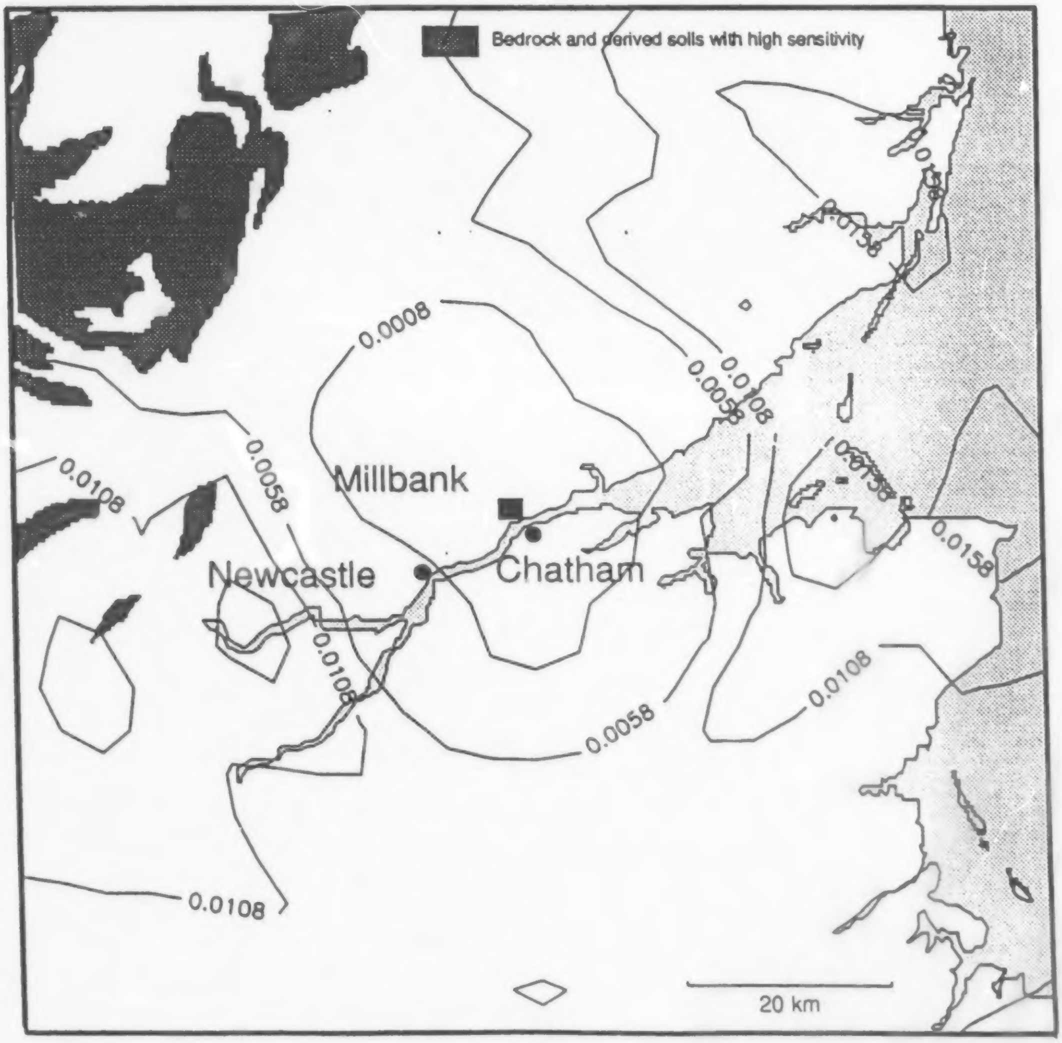

▨ Bedrock and derived soils with high sensitivity
Including 12.9 kg SO4/ha/y background
12.96
12.96
12.96
12.96
12.96
Millbank
Newcastle
Chatham
13.04
13.08
13.04
13.04
13.12
13
13
20 km

FIGURE 7-5

Wet Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
(Annual capacity factor equivalent to 2000 hours of operation)


▨ Bedrock and derived soils with high sensitivity
0.0158
0.0008
0.0058
0.0108
0.0158
Millbank
Newcastle
Chatham
0.0158
0.0108
0.0058
0.0108
0.0108
20 km

location. These levels are negligible. It should be noted that measurements of wet deposition are not meaningfully reported more precisely than to the nearest to 0.1 kg SO_4/ha/y. Therefore the impact of the proposed TGS on wet deposition will be negligible.

7.1.3.7 Model Predictions - Combined Sources

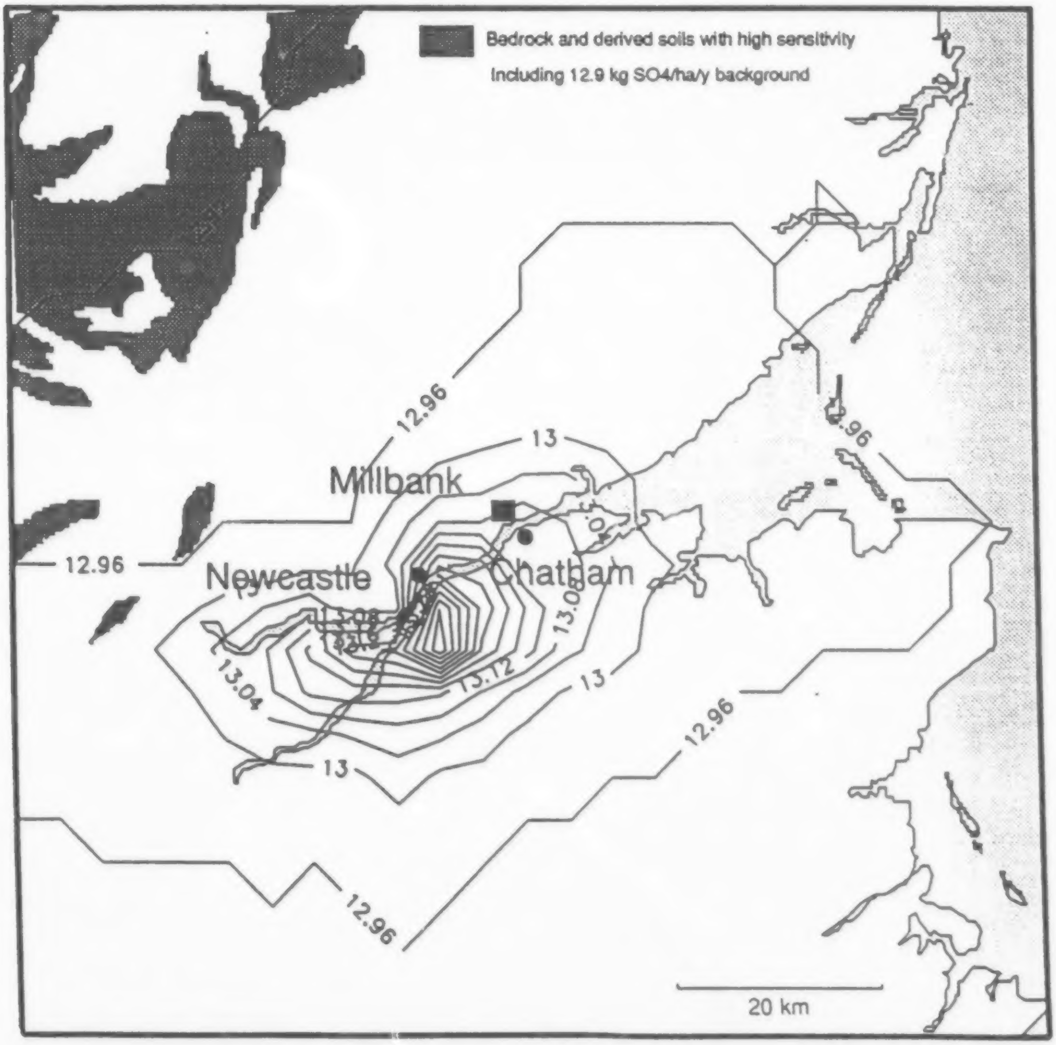
Model predictions of the wet deposition due to the combined sources with 500 and 2000 hours of operation per year for the proposed TGS are illustrated in Figures 7-6 and 7-7, respectively. These illustrations include a background wet deposition level of 12.9 kg SO_4/ha/y. The maximum predicted incremental wet deposition due to the combined sources is 1.07 kg SO_4/ha/y at a location 14.6 km SW of the proposed TGS (Tables 7-11 to 7-13). The maximum level predicted is the same for 500 and 2000 hours of operation of the proposed TGS, hence the contribution of the proposed TGS is negligible at this location.

This level is just approaching the level considered adequate to protect the most sensitive aquatic systems, namely 14 kg SO_4 per ha per year. It is also well below the recommended target loading for the wet sulphate deposition of 20 kg SO_4/ha/y considered adequate to protect moderately sensitive aquatic system. There are high to intermediate sensitive soils at the location where the maximum predicted wet deposition in the Millbank airshed is predicted to occur.

Model predictions of the total deposition (wet plus dry) due to the existing and the proposed TGS sources are illustrated in Figures 7-8 and 7-9 corresponding respectively to 500 and 2000 hours of operation per year for the proposed TGS. The maximum predicted total deposition due to all existing and future sources ranges from 6.03 to 6.06 kg/SO_4/ha/y for the cases where 500 and 2000 hours of operation of the proposed TGS are considered (Tables 7-11 to 7-13). The proposed TGS therefore has a very small impact on the total deposition levels.

FIGURE 7-6

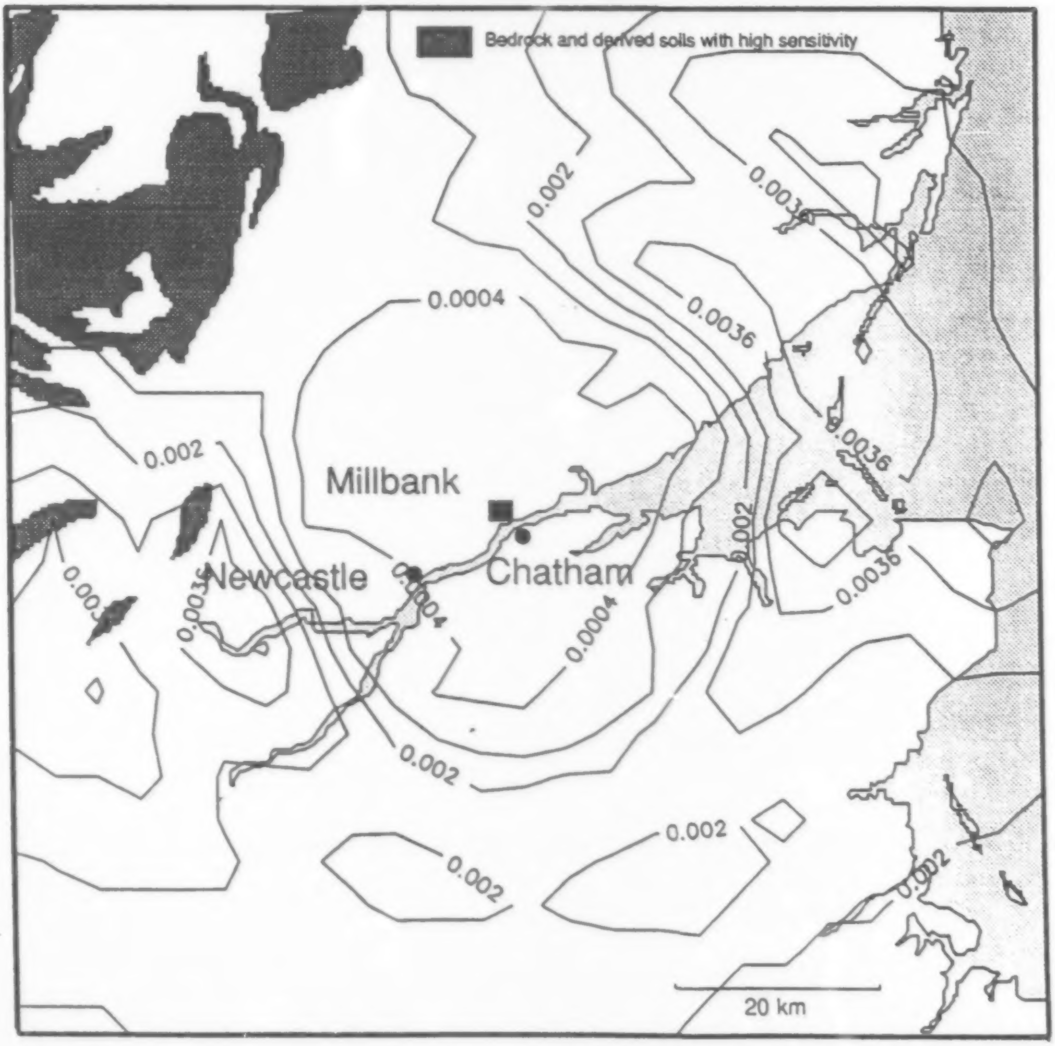
Wet Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
And The Existing Sources In The Airshed
(Annual capacity factor equivalent to 2000 hours of operation)



▨ Bedrock and derived soils with high sensitivity
Including 12.9 kg SO4/ha/y background
Millbank
Newcastle
Chatham
12.96
12.96
12.96
12.96
12.96
13
13
13
13.04
13.04
13.08
13.08
13.12
20 km

FIGURE 7-7

Wet Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
(Annual capacity factor equivalent to 500 hours of operation)



■ Bedrock and derived soils with high sensitivity
0.002
0.0036
0.0004
0.0036
0.0036
0.002
Millbank
0.002
0.0036
Newcastle
0.003
0.0036
0.0004
Chatham
0.0004
0.002
0.002
0.002
0.002
0.002
20 km

TABLE 7-11

Deposition Modelling for The Proposed Millbank Combustion Turbines (500 hours/y)

Sources	Annual Emission k tonnes/y	% of Airshed Emissions	% of Deposition in Model Domain		Maximum Deposition			
					Amount kg SO4/ha/y		Location (km, dir)	
			Wet	Total	Wet	Total	Wet	Total
Millbank Combustion Turbines	0.63	21.4	4.2	8.0	0.01	0.67	(29.2,E)	(1.7,E)
Miramichi Pulp & Paper	0.30	10.2	9.1	8.7	0.05	0.39	(12.7,SSW)	(11.8,SSW)
Miramichi Package	1.40	47.7	61.7	60.9	0.68	4.50	(14.6,SW)	(14.6,SW)
Hog Fuel Boiler	0.11	3.6	8.2	7.2	0.35	1.29	(14.6,SW)	(14.6,SW)
Chatham TGS	0.50	17.0	16.8	15.2	0.11	0.76	(6.8,SSE)	(4.5,SSE)
TOTAL	2.93	100.0	100.0	100.0	1.07	6.03	(14.6,SW)	(14.6,SW)
Percentage of Total SO2 Emissions Deposited Within The Model Domain			1.1	8.6				

TABLE 7-12

Deposition Modelling for The Proposed Millbank Combustion Turbines (1000 hours/y)

Sources	Annual Emission ktonnes/y	% of Airshed Emissions	Maximum Deposition					
			% of Deposition in Model Domain		Amount kg SO4/ha/y		Location (km, dir)	
			Wet	Total	Wet	Total	Wet	Total
Millbank Combustion Turbines	1.26	35.3	8.1	14.7	0.01	1.34	(29.2,E)	(1.7,E)
Miramichi Pulp & Paper	0.30	8.4	8.7	8.1	0.05	0.39	(12.7,SSW)	(11.8,SSW)
Miramichi Package	1.40	39.3	59.2	56.4	0.68	4.50	(14.6,SW)	(14.6,SW)
Hog Fuel Boiler	0.11	2.9	7.9	6.6	0.35	1.29	(14.6,SW)	(14.6,SW)
Chatham TGS	0.50	14.0	16.1	14.2	0.11	0.76	(6.8,SSE)	(4.5,SSE)
TOTAL	3.56	100.0	100.0	100.0	1.07	6.03	(14.6,SW)	(14.6,SW)
Percentage of Total SO2 Emissions Deposited Within The Model Domain			1.0	7.7				

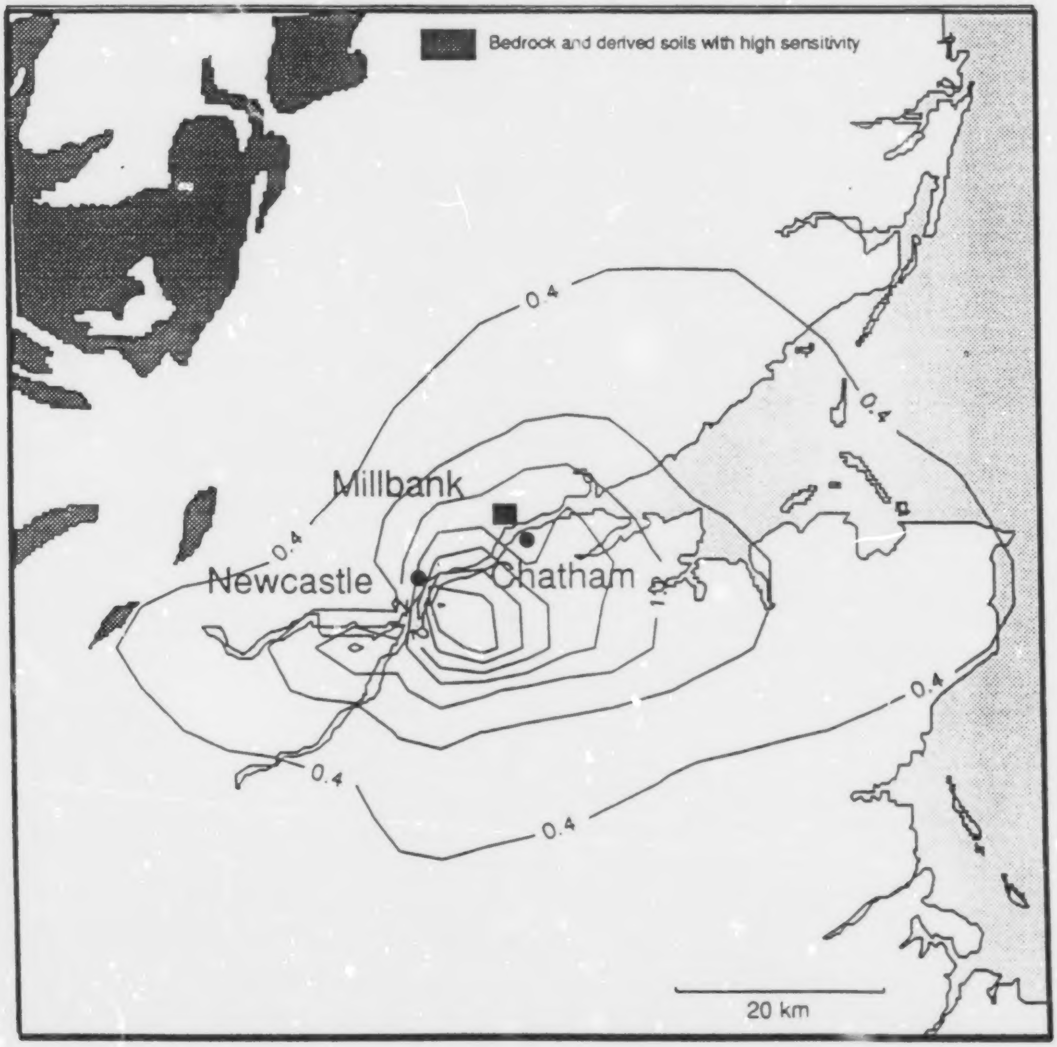
TABLE 7-13

Deposition Modelling for The Proposed Millbank Combustion Turbines (2000 hours/y)

Sources	Annual Emission ktonnes/y	% of Airshed Emissions	% of Deposition in Model Domain		Maximum Deposition			
					Amount kg SO4/ha/y		Location (km, dir)	
			Wet	Total	Wet	Total	Wet	Total
Millbank Combustion Turbines	2.51	52.1	15.0	25.7	0.02	2.68	(29.2,E)	(1.7,E)
Miramichi Pulp & Paper	0.30	6.2	8.1	7.0	0.05	0.38	(12.7,SSW)	(11.8,SSW)
Miramichi Package	1.40	29.1	54.7	49.1	0.68	4.50	(14.6,SW)	(14.6,SW)
Hog Fuel Boiler	0.11	2.2	7.3	5.8	0.35	1.29	(14.6,SW)	(14.6,SW)
Chatham TGS	0.50	10.4	14.9	12.4	0.11	0.76	(6.8,SSE)	(4.5,SSE)
TOTAL	4.82	100.0	100.0	100.0	1.07	6.06	(14.6,SW)	(14.6,SW)
Percentage of Total SO2 Emissions Deposited Within The Model Domain			0.8	6.5				

FIGURE 7-8

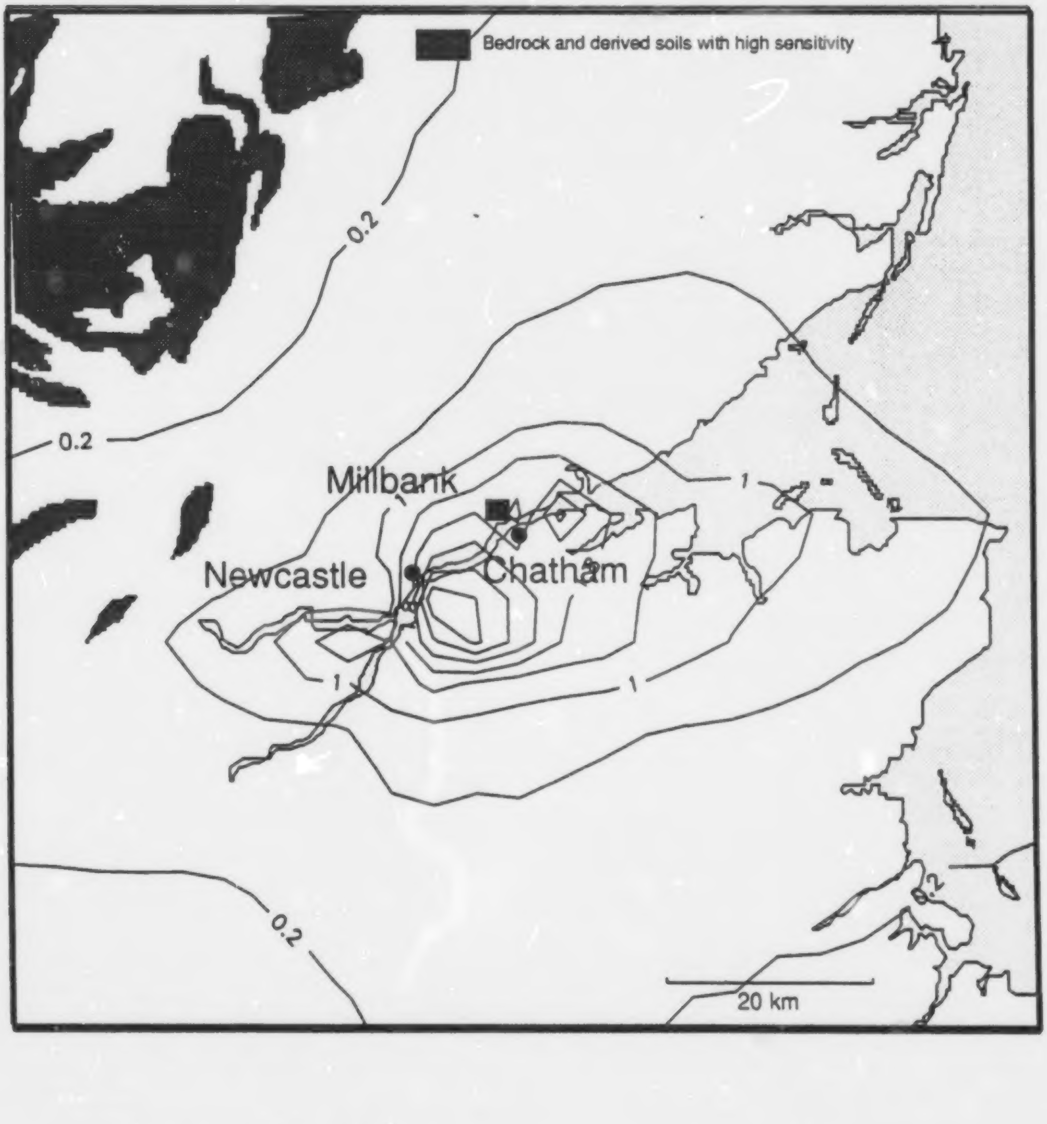
Total Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
And The Existing Sources In The Airshed
(Annual capacity factor equivalent to 500 hours of operation)



Bedrock and derived soils with high sensitivity
0.4
0.4
0.4
Millbank
Newcastle
Chatham
0.4
0.4
0.4
20 km

FIGURE 7-9

Total Annual Sulphate Deposition (kg SO4/ha/y)
From The Proposed Millbank Combustion Turbines
And The Existing Sources In The Airshed
(Annual capacity factor equivalent to 2000 hours of operation)


▆ Bedrock and derived soils with high sensitivity
0.2
0.2
Millbank
1
Newcastle
Chatham
1
1
1
2
0.2
20 km

7.1.3.8 Assessment of Impacts Due to Deposition

The currently predicted incremental deposition levels in the airshed due to the combined sources are small (less than 1.07 kg SO_4/ha/y). The proposed Millbank TGS is predicted to contribute a maximum of 0.01 kg SO_4/ha/y based on 500 hours per year of operation. Even if the proposed Millbank TGS operated for 500 hours during the winter months alone, i.e., one-quarter of the year, maximum winter wet deposition would be expected to be similar to an annual deposition based on 2000 hours per year. The maximum predicted wet deposition due to the TGS alone is 0.02 kg SO_4/ha/y under these conditions. In addition, the airshed for the proposed Millbank TGS (defined as an area within a 50 km radius of the proposed TGS), has a very small area (<10%) of soils classified as having high sensitivity to acid deposition. Surface waters in the airshed have been largely unclassified with respect to their susceptibility to acidic deposition. The maximum predicted wet deposition due to the combined sources (and including a background wet deposition level of 12.9 kg SO_4/ha/y) is 13.9 kg SO_4/ha/y. The maximum level is predicted to occur over a very small area which does not have highly sensitive soils.

Model predictions of the wet deposition were made for sulphate deposition based on SO_2 emissions. NO_2 is emitted from the proposed Millbank TGS also in amounts that are 50 percent of the SO_2 emissions. The deposition of nitrate species will be more than a factor of two lower than sulphate (when account is taken of the molecular weights of NO_2 and NO_3 compared with SO_2 and SO_4). The impacts of nitrate deposition will therefore be negligible.

The Guidelines require an analysis of the impact of gaseous emissions from the operation of the facility on human health and the effects of SO_2 and NO_x on sensitive vegetation, including local forests, agricultural crops and blueberries and the economic impact of these effects on commercial forestry and agricultural operations. The commercial Christmas tree species of Balsam Fir and Scotch Pine are not considered unusually sensitive to SO_2 and there will be no adverse economic impact from emissions upon the nearby plantation. The currently anticipated deposition levels are small (less than 0.9 kg SO_2 per hectare per year). Because of the very small incremental deposition due to the operation of the proposed facility, no impacts on any receptors are predicted. The maximum acceptable air quality objectives are designed to provide adequate protection against effects of pollutants on vegetation, soil, animals, visibility, personal comfort and well being. It should be noted that the maximum tolerable objective levels, which are higher than the maximum acceptable levels, denote concentrations above which appropriate action is required to protect human health. The predicted ground level concentrations due to the proposed Millbank TGS current clearly are below the maximum acceptable objectives and thus will not pose any threat to human health. It is therefore not anticipated that there will be any impact on human health or any economic impacts on the agricultural or forestry sectors attributable to the operation of the proposed TGS.

The predicted wet deposition due to the proposed Millbank TGS at borders of the domain are 0.01 kg SO_4/ha/y or lower. Potential impacts on the neighbouring provinces of Nova Scotia to the south and southeast and Quebec to the north will therefore be negligible.

7.1.4 Canada-New Brunswick Sulphur Dioxide Emission Reduction Agreement

In 1987 New Brunswick entered into an agreement with the Government of Canada to reduce its total sulphur dioxide emissions to 185 kilotonnes by 1994. Efforts are underway to reduce the emissions from some of the existing sources in the Newcastle area. New Brunswick Power was allocated 130 kilotonnes of the provincial total, and has developed a program to control SO_2 emissions in order to meet that target by 1994. This program was first formulated in 1988 and was reviewed in early 1990 as a result of the recent decision to include a flue gas desulphurization system (scrubber) with the new Belledune Generating Station. The program is documented in NB Power's report entitled "Sulphur Dioxide Control Program, 1990-2000" (January 1990).

The program is a flexible one which encompasses a series of alternative approaches. It will result in emissions being reduced to the range of 89 - 116,000 kilotonnes in 1994, depending on the alternative which is eventually implemented. Emissions in the year 2000 are estimated to be in the range of 83 - 93,000 kilotonnes, again dependent upon which alternative approach is implemented. The program does not consider the Millbank TGS as the market opportunity and the associated requirement for this project were not apparent at the time of the review.

The SO_2 emissions associated with the planned operation of the Millbank TGS (i.e., at 500 hours per year, or 6 percent of capacity factor) have been calculated to be 0.6 kilotonnes per year. Clearly this is a very minor amount, and will have no implications in terms of NB Power's program to meet its share of the New Brunswick target emission level.

7.2 Power Transmission

7.2.1 Electric and Magnetic Fields

7.2.1.1 Introduction

The issue of electric and magnetic fields associated with the operation of the new transmission facilities has been raised in the EIA guidelines, and during the public consultation process to date.

Electric and magnetic fields are created wherever electricity flows through a conductor; there are fields associated with transmission and distribution lines, with wiring in homes and work places and with all electrical appliances. These fields decrease rapidly as the distance from the source increases. The issue is whether human exposure to these fields is a health risk. According to Dr. Morgan of the Department of Engineering and Public Policy at Carnegie Mellon University, good scientific research has been conducted on this topic. However, the biological effects of these fields are complicated and not fully understood and therefore risk assessment is difficult (G. Morgan, 1989).

A large body of literature has been published regarding the possible links between electric and magnetic fields (EMF) and various health effects. Earlier studies have been contradictory and have failed to conclusively show that EMF causes any identifiable health effects. Generally, these studies have been epidemiological, that is, studies of effects on populations. These studies have been reviewed by many independent authorities such as the United States National Academy of Sciences (1977), the American Institute of Biological Sciences (1985), the state of Flordia Electric and Magnetic Fields Advisory Commission (1985), the World Health Organization (1984 and 1987) and the New York State Public Service Commission (1988) as referred to in Energy Resources Conservation Board of Alberta (1989), which found that "these authorities have consistently concluded that no adverse health effects have occurred from human exposure to environmental EMFs". Studies are continuing by the electric utilities and government sponsored agencies in North America and elsewhere in response to public concerns. These more recent studies are discussed below.

This section will explain in simple terms some of the issues and concerns related to electric and magnetic fields, particularly in relation to transmission lines.

7.2.1.2 Electric and Magnetic Fields Defined

There are two types of fields created by 60 Hz electricity. These are **electric fields** which result from the strength of the charge, and **magnetic fields**, which result from the motion of the charge. These fields are often referred to as **electromagnetic fields.**

7.2.1.3 Strength and Measurement of Electric and Magnetic Fields

The strength of electric and magnetic fields diminishes with distance from the source of the field. The strength of an electric field depends on the voltage of the object producing the field. High voltage transmission lines produce stronger electric fields than lower voltage distribution lines. It is not necessary for the current to be flowing in an object for the electric field to exist. Any appliance that is plugged in, even if it is not in use, may produce an electric field.

Magnetic fields, on the other hand, are produced by currents; stronger currents produce stronger fields. Appliances that are plugged in but not in use do not produce magnetic fields. The magnetic field is stronger if the appliance is operated on a "high" rather than a "low" setting.

The strength of an electric field is measured in units of volts per meter (V/m) or in kilo volts per meter (kV/m) for stronger fields. The strength of magnetic fields is measured in units of **milligauss** and **microtesla.** There are 10 milligauss in one microtesla. Field strengths for transmission lines crossing open terrain can be calculated. These calculations are more difficult and less reliable in more complex settings.

Both electric and magnetic fields can add to each other or cancel each other out depending on whether they are in phase (they are alternating in strength and direction **together**) or out of phase (they are alternating in a non-synchronous manner and will tend to cancel each other out).

7.2.1.4 Health Risks Associated with Electric and Magnetic Fields

Electric and magnetic fields produce a variety of biological effects, including changes in the levels of specific chemicals the body makes and changes in the functioning of individual nerve cells and the nervous system. It is not possible to say whether these changes involve health risks (G. Morgan, 1989).

Some epidemiological studies indicate a weak association (not a cause) between field exposure and certain forms of cancer. The evidence is non conclusive and some studies find no association. The response of different individuals to electric and magnetic fields varies.

There are two different kinds of studies: those conducted among people in "electrically related" occupations (lineworkers etc.) and those conducted among people with specific cancers, especially leukaemia. Professor Morgan has indicated that

> some of these studies of both kinds have found a statistical association between increases in field exposure and increased cancer rates....Many investigators believe that if they play some role, fields alone will not turn out to cause cancer (i.e. fields will not be an "initiator"). Rather they are more likely to
>
> work together with one or more other environmental factors (i.e. fields will be a "promoter")(G. Morgan, 1989).

The Report of the Working Group on Electric and Magnetic ELF (1-300 Hertz) (Health and Welfare Canada, 1989) reports similar conclusions. This report concludes that:

- available scientific evidence on health effects of these fields is inconsistent and inconclusive;
- some epidemiological studies indicate a possible association with certain cancers and exposure to magnetic and/or electric fields;

- some animal and cell experiments indicate that an interaction between these fields with biological systems produces changes, some of which may have detrimental consequences; and

- some experimental data indicates that a stronger field is not necessarily more dangerous and that some effects occur with weaker fields, but not for stronger fields.

A widely quoted background paper on the biological effects of power frequency electric and magnetic fields prepared by Nair, Morgan and Florig (1989) concludes that the results of current scientific studies are complex and do not yet allow definite conclusions to be drawn about possible risk or strategies to minimize or avoid potential risks. The central nervous system effects, including circadian effects in animals and the possibility of cancer promotion appear the most relevant to concerns regarding public health effects (I. Nair, G. Morgan, and K. Florig, 1989)

Significant studies also discussed in Nair, Morgan and Florig (1989) include the:

- 1979 Wertheimer-Leeper study which found a positive correlation between high current configuration wiring and childhood cancer;

- the 1987 study by Dr. David Savitz which suggests that the close proximity to power lines could possibly lead to a doubling of cancer risk in children, from one case in 10,000 to two cases in 10,000;

- the study by Dr. Richard Stevens which considered data on adult leukaemia in the Seattle area and found no association; and

- numerous other studies, many of which found no association with the particular type of cancer studied.

According to a status report on electric and magnetic fields and potential health effects produced by the American Public Power Association (1989) there are a number of court cases and actions pending against utilities to stop or reroute transmission line

construction. The judicial review of the health risks of electric and magnetic fields is inconclusive, i.e.:

- Klein Independent School District v. Houston lighting & Power where the Texas Supreme Court upheld a ruling by the Texas Court of Appeals finding health risks from exposure to powerline fields (the 354 kV line was rerouted from the original location 60 metres from the school);

- Seattle (Wash.) City Light decided in 1988 to delay for three to five years the construction of a transmission line and substation because of opposition by a citizens group (slower-than-anticipated demand contributed to the decision to delay construction); and

- the Energy Resources Conservation Board (Calgary) concluded in 1989 that the application for the construction of a 240-kV transmission line should not be denied on the basis of health effects and that the question of health effects should not influence its decision on the appropriate location of the line (TransAlta Utilities Corporation, 1989).

It is noteworthy that the Bridlewood line in Ontario and the Dunsmuir-Gold River line in British Columbia were allowed to be built.

The U.S. Environmental Protection Agency has indicated that there is not enough compelling science to initiate federal regulations of electric and magnetic fields. Several states have their own regulations. The Office of Technology Assessment advocates "prudence avoidance" strategy including:

- wider transmission line corridors;
- routing of new lines away from people;
- new low-field distribution system and house wiring designs; and
- redesigned appliances (Nair, Morgan and Florig, 1989).

7.2.1.5 Potential Effects

The Guidelines for the EIA of the project require that the possible implications of electric and magnetic fields to human health for residents of affected areas be addressed. The field calculations at Millbank for the magnetic and electric fields for the 38 m right-of-way area:

- Maximum magnetic field within the right-of-way--------120 mGauss
- Magnetic field at edge of right-of-way-----------------25 mGauss
- Maximum electric field within right-of-way-------------3.0 kV/m
- Electric field strength at edge of right-of-way--------0.74 kV/m

Field calculations at Millbank for the magnetic and electric fields for the 90 m right-of-way are:

- Maximum magnetic field within the right-of-way-----200 mGauss
- Magnetic field at edge of right-of-way------------------61 mGauss

- Maximum electric field within right-of-way-------------3.0 kV/m

- Electric field strength at edge of right-of-way--------0.8 kV/m

There are no governmental health standards for 60 Hz electric and magnetic fields in Canada. According to Health and Welfare Canada, this is due to the lack of a sufficient scientific basis to establish what such standards should be. There are standards or proposed standards in a few countries. In the United States several states have regulated the maximum electric field strength at the edge of the right-of-way to levels between 1 and 3 kV/m. Standards and proposals in other countries are similar (Health and Welfare Canada, 1989). The strength of the electric field at the proposed right-of-way boundaries is well within the allowable limits where regulations have been established.

The levels of magnetic field at the boundaries of the right-of-way are similar to the upper end of magnetic fields found in homes, lower than magnetic fields found near appliances in homes and comparable to magnetic fields found in typical office environments (Health and Welfare Canada, 1989).

There are no residential dwellings or other buildings used by people within 100 m of the right-of-way boundary. The only residences within 300 m of the proposed transmission line are at the intersection of Route 8 and the McHardy Road and on the Beaverbrook Road. Estimated levels for both electric and magnetic fields at the boundary of the right-of-way are not anticipated to augment risks to public health for local residents.

7.2.1.6 Radio and Television Interference

AM Radio Reception

Radio signal interference to frequencies used for radio transmission are mainly disrupted by the electromagnetic field (corona) surrounding the conductors in the line. The corona frequencies emitted from the powerlines can be similar to those received by radios. The level of interference is dependent on the power (voltage) carried by the line and the distance from the line or station to the receiving source.

The Canadian Standards Association (CSA) has developed limits for amount of electromagnetics noise that can be generated by power lines. For the transmission lines coming out of the Millbank station the noise limitation is 53 dB (dB is the same measurement used in Section 4.6 of the report; that is, sound pressure level measured by a radio receiver). NB Power will comply with this standard.

The second factor that affects radio interference is the distance of the receiver from the noise creating equipment.

Formulae have been developed to calculate the distance from the noise source which will provide good radio reception. The formula often used was developed by the CSA. It is:

$$20\mathrm{Log}_{10}D = \frac{S - SN - N}{A} + 20\mathrm{Log}_{10}D'$$

where

D = Direct distance from the nearest conductor of the power line or station to the radio receiving antenna, in metres.

S = Field strength of the AM radio broadcast signal to be protected, in dB above $1\mu V/m$, measured with an average or RMS detector.

SN = Signal to noise ratio for Class C reception, in decibels.

N = Maximum permissible noise level, specified by the CSA.

A = An empirical factor determined by the rate of attenuation of electromagnetic noise as a function of the direct distance from the nearest conductor. In the AM broadcast band, A = -1.65 for typical power lines at distances less than 100 m from the line. If results of field measurements for the line under consideration are available, the value of A from these measurements should be used.

D' = Direct distance from the nearest conductor of the power line or station to the measurement location specified in Clause 4.5, in metres.

$D' = ((H - h)^2 + L^{2)1/2}$

where

H = Height of nearest conductor above ground, in metres.
h = Height of antenna above ground, in metres.
L = Lateral distance to measurement location.

Using this calculation it can be shown that by complying with the CSA standard of 53 dB for corona discharge, the distance from the transmission lines that permits noise free radio reception is approximately 4 metres.

This calculation also applies to the TGS and any substations associated with the plant.

Television and VHF Reception

Most VHF noise originates from faulty insulators or from spark discharges between adjacent items of the metallic hardware.

Typically this type of noise is caused by loosely-stapled ground wire, loose spacer bolts, loose or cracked insulators and loose cross-arm braces. These discharges affect the television by producing horizontal lines that move slowly up the screen.

Care during construction (during the installation of the lines) and the purchase of static noise free parts for the line such as static free ground wire staples and clamps will eliminate the discharges that cause television interferences.

Because the TGS will be located at a distance greater than 4 m from any dwelling and the generator will be enclosed in a metal clad building there will be no reception interference from the generating facility.

7.2.2 Visual Impacts

The proposed transmission lines will have a visual impact on local residences where they cross the McHardy Road and the Beaverbrook Road. In addition, a switching station will be located where the proposed transmission lines cross the Beaverbrook Road.

7.3 Noise Generation and Vibration

7.3.1 Noise Generation

This section will discuss the impacts of operation noise on the local residents.

Residents in the vicinity of the proposed generating station, particularly residents of the Rockcliffe subdivision have expressed concern regarding noise from the operation of the facility. Chapter 4 of this study indicates the predicted ambient noise levels in the vicinity of the plant. Ambient levels are greatest at peak traffic periods (0700-1900 hours and 1530-1730 hours). Average ambient noise levels for peak traffic periods ranged from 33 to 52 dB(A). Average nighttime levels ranged from 33 to 36 dB(A). The major source of noise in the area is traffic on Routes 11 and 8. The planned realignment of Route 8 will bring the highway closer to the proposed site and will increase the level of noise in the vicinity. Other sources of sound in the area are distant rail traffic, distant industrial plants, barking dogs, wind, CFB Chatham air base, and vessel traffic in the Miramichi River shipping channel.

State-of-the-art noise reduction measures will be incorporated into the turbine generating station and other facilities. The air intake system will incorporate a 2.4 m silencer optimized to attenuate higher frequencies of sound. The ducting will be acoustically lined. The turbine stack will also be acoustically lined to minimize this source of noise. In addition, all secondary station intakes and exhaust openings will have silencers. The buildings, and particularly the generator enclosure, will also be acoustically lined. A summary of the 'A'-weighted noise levels for the major sources, based on manufacturer's specifications and data for similar plants, is given in Table 7-14.

The estimated range for levels of sound during operation of the power plant at those habitated locations nearest the site are given in Table 7-15. These estimated levels take into account distance from the source, prevalent wind directions and the type of terrain between the source and point of reception.

Fuel oil deliveries to the power plant site would increase truck traffic in the area by two to ten passes per hour. This would be expected to take place during working hours under normal conditions. The resultant increase over existing traffic noise levels would be approximately about 0.6 dB (typical) for an additional two trucks per hour to as high as a 2.5 dB increase (worst case) for an additional ten trucks per hour. As noted previously, noise level increases of up to 3 dB are not usually significant. Under typical conditions, the increase in noise from truck traffic resulting from oil deliveries to the proposed combustion turbine power plant will be negligible.

Noise levels attributable to the operation of the proposed project will be similar to current daytime levels. The nighttime noise levels are anticipated to be comparable to the present daytime levels, and thus will exceed current ambient nighttime noise levels. The maximum nighttime levels are expected to be 39 to 43 dB(A). This level is "normally

TABLE 7-14

Power Plant Operation - Noise Emissions

Source	Noise Levels[a]	
	One Turbine	4 Turbines
	dB(A)	dB(A)
Air Intake	50	56
Exhaust	48	54
Enclosures	48	54
Air Cooler	45	51
Ventilation System	36	42
Transformer	46	52
Oil Pumping Station	43	-

[a] - measured at 120 m from source

TABLE 7-15

Sound Levels - Operating Periods

Location[a]	Sound Level dB(A)
1	37-42
2	38-42
3	36-40

[a] - refer to Figure 4-10

acceptable" and is between the noise level present in a public library and that typical of a noisy office. The facility is expected to operate primarily in the winter months when people will have their windows closed and will not be sitting outside in their gardens or on their decks. Thus the effect of these levels is expected to be minimal, although this will be noticeable if the plant is required to operate during the summer months. This is not expected to occur in any but unusual conditions such as the loss of the Point Lepreau Generating Station from the NB Power system, or a similar emergency conditions.

7.3.2 Vibration

Ground-borne vibration from construction activities and operation of the plant will be imperceptible at the nearest residences (approximately 1000 m from the plant location). Any ground-borne vibration will be significantly attenuated by the intervening terrain to well below the existing levels of ground vibration due to road traffic.

The potential for the air-borne vibration of lightweight dwelling components, such as windows, may exist during the operation of the power plant. This effect would be observed at the nearest residences as the barely perceptible vibration of windows when touched. The level of vibration would be less than that which may currently occur due to road traffic.

7.3.3 Effects on Wildlife

The absence of sensitive wildlife habitat at and near the site and the "conditioning" of the area by the present levels of sound will mitigate any effects of noise on wildlife due to operation of the power plant.

7.4 Socioeconomic Effects

7.4.1 Introduction

The proposed Millbank TGS has an estimated operating life of 20 years. Potential socioeconomic effects from the operational phase of the plant include:

- effects of the presence of the facility on the quality of life of local residents and on local property values;
- effects on the labour force and local business opportunities resulting from employment and expenditures associated with the operation of the facility; and
- effects on community services and infrastructure, including the impact on the tax base in the Ferry Road-Russellville Local Service District.

Also of some socioeconomic concern are the issues of noise generation, possible effects on the groundwater supply in the area, effects of increased truck traffic and of accidental fuel spills, and the potential effects of electromagnetic fields associated with transmission lines. These issues are dealt with elsewhere in this chapter, and the focus in this section will be on the points identified above.

7.4.2 Property Value and Quality of Life

7.4.2.1 Potential Effects

The issue of land value requires the study of all value influences. Change and anticipation influence value fundamentally. They characterize human collective actions and value judgements. Anticipation means that value of a property is not based on historical prices or cost of creation; it is based on what market participants perceive to be the future benefits of acquisition.

In the case of owner-occupied properties, value is primarily based on expected future advantages, amenities, and pleasures of owning and occupying a particular property. For income-producing real estate, value is based on anticipated future flows produced by property.

Local residents have indicated concern that the presence of the project will decrease property values. There is concern that the quality of life in the area will be diminished and that demand for local property will decrease. Major concerns related to property values and quality of life include:

- an increase in ambient noise levels;
- potential problems with water quality and quantity;
- the increase in traffic and traffic noise (especially from fuel delivery);
- a change in the aesthetic nature of the area;
- the potential of increased human health problems from emissions from the TGS; and
- the implications for further residential development in the area.

As indicated in Section 4.6 and 7.3, there will be very little increase in the ambient noise levels from plant operation. The increase will be primarily at night during the winter months. Under normal planned operation, there should be minimal disturbance.

Water quality in the area is not anticipated to change as a result of the operation of the Millbank TGS. Mitigative and control measures indicated, and the guarantee by NB Power for full responsibility should prevent this issue from impacting on local property values.

There will be eight to ten trucks delivering fuel daily. During operation the facility will be unmanned and operated from the Chatham plant although two people will be on-site during fuel delivery. There will be occasional maintenance vehicles.

The visual impact the of the facility will not be obtrusive. The TGS will be only partially visible from most of the residences in the area of the Rockcliffe Road and Route 11. The fuel storage tanks (15 m in height), the buildings housing the turbine units (21.3 m in height), and the four stacks (45 m in height) will be visible over the trees which surround most of the plant site. The trees at maturity will be approximately 12 to 18 metres in height. Because the plant will be set back from Routes 8 and 11 with tree cover over most of the area, it will not be visually obtrusive.

Emissions from the operation of the facility including emission levels in the immediate area will be minimal and do not pose a problem to human health.

The Millbank TGS could have both direct and indirect implications for future residential development in the immediate area. The direct impact involves the removal of approximately 269 ha of potential residential development land. This represents approximately 34 potential building lots along Route 11 and the McHardy Road. It is unlikely that this will have a significant impact because the supply of land available for residential development exceeds the current and anticipated market in the area.

The construction of a transmission line could affect future residential land use, especially where the line crosses Route 8 and the Bellefond Road. It is estimated that the transmission line corridor will, at most, affect a total of six building lots on the existing

Route 8 and the Bellefond Road. The removal of six potential building lots would have no significant affect on residential development in the area.

Indirect impacts include:

- the increase in noise over ambient levels;
- the visual impact of the generating station; and
- the presence of a non-residential land use in the area.

The effect of these impacts on future residential development will depend to some extent on the subjective perceptions of potential buyers. The effects of the operation of the project are anticipated to be minimal and localized, with the exception of the visual impact. The visual change will be more noticeable from across the river than in the immediate area.

Residents of the subdivision will have a protected natural area adjacent to their properties for recreation. This provides protection from further development which could have greater negative impacts than the proposed Millbank TGS.

The Regional Manager of the Assessment Branch of the New Brunswick Geographic Information Corporation has indicated that it is difficult to determine the impact of development projects on property values. Property values may increase with development projects which provide major sources of employment. Property values in Chance Harbour increased with the development of the Point Lepreau generating station (G. Carroll, pers. comm.). Mr. Carroll indicated that it is his personal opinion that property values in the Rockcliffe subdivision will show no major change as a result of this project and will follow the general trends in the Miramichi region. Individuals in the area might move away, but this could be offset by new residents coming to the area (G. Carroll, pers. comm.).

A real estate appraiser familiar with the Dalhousie area indicated that the Tate sub-division was built adjacent to the Dalhousie Generation station subsequent to the building of the plant. New homes in the $50,000 to $60,000 range were built approximately 300 metres from the plant. There is alternative land available in the area for development which would have been used if people had an objection to the facility. The negative impact of the facility was limited to one house on the property line in full view of the coal piles. A buyer could not be found for this property (G. James, pers. comm.).

Effects of the operation of the project, however, are anticipated to be minimal and therefore it is expected that property values in the area will be dependent on the real estate market and general economic development in the Chatham/Newcastle area, rather than being affected by the presence of the Millbank TGS.

7.4.2.2 Control Measures

Measures to mitigate potential impacts on noise levels and water quality and availability have been indicated. Fuel deliveries will normally be confined to regular working hours on weekdays. A buffer of trees will be established and maintained to minimize the change in the aesthetic nature of the area.

NB Power has offered to purchase the six properties of the residents currently living in the Rockcliffe subdivision north of Route 11. Property values will be established by averaging the appraised values of two independent appraisers. The residents will have the option to:

- sell their property to NB Power prior to construction of the facility;

- lock-in the current value of their property (to protect from any negative impact from the proposed plant); and
- continue to live on their properties for several years with the option to sell to NB Power at current value (plus an inflation escalator) if they decide that the operation of the Millbank TGS negatively effects their lifestyle.

7.4.2.3 Residual Effects

No residual effects on property values are anticipated. As indicated above, there will be minimal change in the individual components of quality of life. It is difficult to anticipate how individuals will react to these changes.

7.4.3 Labour Force

7.4.3.1 Potential Effects

Eleven permanent full-time jobs will be created for maintenance and operation of the Millbank TGS. The positions will be for electricians, electrical mechanics, and millwrights. The local labour market Information Analyst with the Newcastle office of Employment Canada has indicated that the local labour market does not have sufficient unemployed workers with the skills required for these positions. With the recent expansion at Repap, it was necessary to bring in workers from Newfoundland and from western Canada (pers. comm. P. Richard).

Using the employment multiplier from the 1979 Statistics Canada Input-Output Model, it can be estimated that a total of 14.75 direct and indirect jobs will be generated in New Brunswick as a result of the operation of the facility. In addition there will be induced employment resulting from incremental household spending in the area. Induced employment is defined as jobs that will be generated through incremental household spending due to general economic expansion in an area. Any increase in employment in the area is a positive impact in an area suffering from unemployment.

The total expenditure on labour during the operation of the facility will be approximately $473,000 annually. Using the labour income multiplier from the 1979 Statistics Canada Input-Output Model, it can be estimated that a total of $710,000 in direct and indirect labour income will be generated in the Province as a result of the operation of the facility.

7.4.4 Local Business Opportunities

It is not anticipated that there will be any direct contracts as a result of the operation and maintenance of the project. Most maintenance work will be carried out by NB Power maintenance workers who serve generating facilities throughout the Province. There will be an increment in household spending from wages and salaries which will translate into increased business opportunities in the area.

7.4.5 Community Services and Infrastructure

Development projects can have a negative impact on community services and infrastructure by making demands in excess of the capacity of existing services and a positive impact by increasing the tax base, thereby increasing the ability of the community to provide services or reducing the tax rate for residents.

Water and sewage services are not provided by the Local Service District; the project will have its own water supply and septic system. There will be a water storage facility at the site for use in controlling fire. Corporal McNeil of the Newcastle Detachment of the RCMP has indicated that no increase in police service needs attributable to the operation of the proposed TGS is anticipated (McNeil, pers. comm.). With a maximum of 11 families moving to the Chatham/Newcastle area as a result of the project, it is not expected that there will be any increase in enrollment in the local schools beyond current capacity.

The hospitals in Chatham and Newcastle have occupancy rates lower than the provincial average and will be able to accommodate the small increment in population resulting from the operation of the project.

Fire protection will be provided by the operational staff from the Chatham TGS and the Douglastown Fire Department with backup assistance from the Chatham Fire Department and the Newcastle Fire Department, if necessary.

The 1990 tax base for the Ferry Road-Russellville Local Service District would increase from $24,583,850 to $29,083,850 as a result of the implementation of the project. Because of the limited services provided by the local service district, the Northumberland County Municipal Services Representative has indicated that this would lower the local tax rate for local residents approximately 18 percent (D. Rae, pers. comm.). The Provincial rate of $.65 per $100 would remain the same. This would represent an annual saving of approximately nine dollars on a residential property assessed at $80,000.

No substantial increment in solid waste generation is anticipated from the operation of the plant.

7.5 Potential Groundwater Impacts

The potential impact of the proposed development on the groundwater resource is primarily a function of two main factors: the quantity of water required; and the time period over which this quantity is to be extracted. It is expected that in the order of 66 L/s will be required when the plant is in operation.

7.5.1 Watertable Supply

From a groundwater perspective, the greatest stress on the aquifer would occur when there is continuous water demand for a period of several days. Although such a demand profile would not be expected in ordinary circumstances, a computerized analysis of aquifer response for time periods of five, ten, and twenty days of continuous demand was completed. The aquifer response to pumping was modelled using the Theis analysis and was based on the aquifer parameters obtained from the pump test data. Table 7-16 presents the results of the analysis.

Analysis of the pump test data indicates that pumping test well 90-2 at a rate of 23 L/s for five days would produce a water table drawdown of 9.1 m at the production well, a drawdown of 1.4 m at a distance of 500 m, 1.0 m at 750 m and 0.8 m at 1000 m. Pumping at a lesser rate or for a shorter time period would result in a reduced level of drawdown.

The proposed development has a requirement of approximately 66 L/s, and test well 90-2 has been shown to be capable of supplying up to 23 L/s. This would suggest that a minimum of two additional wells of equivalent capacity would be required. In order to provide this level of capacity and ensure that the plant could continue to operate in the event of a pump failure or similar circumstance at one well, it is expected that four to five wells will eventually be required. This would provide a total potential capacity well in excess of the station's requirement and would mean that wells would not need to be pumped at a maximum level. This would reduce the drawdown impact around operating wells and reduce the interference between them.

The impact of drawdown must also be considered in the context of the existing residential wells in the area. An adequate buffer distance should be maintained between production wells and domestic wells in order to minimize the drawdown in residential wells during operation of the facility. Evaluation of Table 7-16 suggests that a drawdown of less than 2 m would be expected at a distance of 500 m from a production well. It is recommended that a minimum separation distance of 500 metres between production wells and domestic wells be maintained. The location of production wells has not been finalized but the proposed locations are 650 m or more from existing dwellings.

TABLE 7-16

Distance drawdown (m) for pumping rate of 23 Litres/second

Continuous Pumping time (days)	Distance from pumping well (m)			
	at well	500	750	1000
5	9.1	1.4	1.0	0.8
10	9.4	1.8	1.4	1.1
20	9.7	2.1	1.7	1.4

The hydrostatic test program related to the commissioning of the fuel storage tanks will provide an opportunity to confirm the findings of the groundwater exploration program in advance of plant operations. The test of the first tank will take place during February of 1991; this date falls within the expected period of operation of the plant when in service. The water for the test will be drawn from the plant production wells, all of which will be closely monitored to provide complete data respecting drawdown of the water table on site. Nearby residential wells could also be monitored during these tests.

7.5.2 Saline Intrusion

Another groundwater impact which should be taken into consideration is the potential for salt-water intrusion. Since the production wells extend to a depth lower than sea level, over-pumping for an extended time period has the potential to draw from the water table below the salt water interface and possibly result in salt water intrusion. This is undesirable from an operational point of view, as well as from an environmental standpoint, but would not be expected to occur in the present situation if the recommended pumping levels are not exceeded. Comparison of the drawdown levels at the well as shown in Table 9-5 indicate drawdowns of 9 to 10 m based on a pumping rate of 23 L/s and time periods of 5 to 20 days of continuous pumping. Since the static water level is in the order of 45 m above sea level in the vicinity of well 90-2 and the expected drawdown is less than 10 metres, there is a considerable margin of assurance that there is a low likelihood of salt water intrusion. Pumping level control probes could be installed in the production wells as a precautionary measure to stop the pump when the water level reaches 10 m above sea level.

7.5.3 Aquifer Recharge

Based on the annual precipitation in the area, it is possible to estimate the amount of recharge reaching the aquifer. Studies performed on Prince Edward Island (PEI Department of the Environment, 1989) reveal that approximately 30 percent of the precipitation reaches the groundwater on the Island. The study was performed on the Winter River Basin, which is 63 km^2, and is composed of approximately 70 percent agricultural land and 25 percent forest. A more conservative value of 10 percent recharge is usually used in New Brunswick when calculating the baseflow contribution of precipitation.

Based on gauge station reports (Chatham A station), the mean annual precipitation for the study area is estimated at 1,085 mm. Assuming 10 percent infiltration, an area of 0.25 km^2 would provide the recharge for the 5 day/year water demand of the plant and an area of 0.5 km^2 would provide recharge for 10 day operating period. The recharge area for the projected well field location is estimated at 2.0 km^2, which should be adequate to meet the annual recharge requirements.

7.6 Fuel Delivery and Management

The proposed Millbank TGS will require 375,000 barrels of oil annually. The fuel will be trucked to the facility from as far away as Saint John or Dartmouth. Concerns include:

- the increase in traffic and the potential increase in accidents and accidental spills from trucking the fuel;
- the noise created by eight to ten trucks daily delivering fuel to the site;
- impact on the capacity of highways;
- the incremental traffic on Route 11 and on the delivery routes to the site; and
- the potential for accidents and accidental fuel spillage with the delivery trucks and tankers and the impact on ground and surface water.

7.6.1 Potential Effects

7.6.1.1 On-Site

Fuel spills could occur as a result of the transfer or storage of fuel at the on-site storage tanks. Containment features are designed in order to prevent migration of fuel oil to adjacent compartments of the environment or from the storage tank.

The overburden in the area consists of sandy till underlain by fractured bedrock. It is anticipated that any petroleum product which reached the ground would rapidly percolate downward until the groundwater table was reached. The contaminant plume would then be expected to migrate in a southerly direction in accordance with the regional groundwater flow pattern. The rate at which the product will move can be derived by the groundwater velocity, previously calculated at 6.4 m/day. Based on this value, the time separating loss of product near the plant area and contaminants reaching private wells along Highway 11 can be estimated at 100 days. This buffer time period would allow for remedial action to be taken in order to protect the private wells.

If, however, the spill occurs while the plant is operating, the production wells used by the plant would be expected to substantially delay contaminant migration, due to the gradient caused by the drawdown cones of the production wells.

7.6.1.2 Off-Site

Transportation System

Diesel fuel for the Millbank TGS will be delivered from refineries from as far away as Saint John, New Brunswick or Dartmouth, Nova Scotia by tanker truck. If fuel deliveries are year-round, eight truckloads per working day will be required to provide sufficient fuel to operate the turbine generating station. If fuel deliveries are April 1 to November 1, ten trucks per day will be required. Travelling from Saint John, tanker trucks will operate either on Routes 7 and 8 or on Routes 1, 2, and either 126 or 15 and 11 or the new Route 8 in the short term to travel to the Millbank TGS. The initial short term layout will see a level intersection at the juction of the McHardy Road and the new alignment of Route 8. However, when the Newcastle-Douglastown By-pass is constructed the interchange in the vicinity of the McHardy Road will be constructed, and at that time McHardy Road will lose access to the new alignment of Route 8. Tanker trucks from Dartmouth will likely follow Route 2 and either 126 or 15 and 11 to travel to the Millbank TGS.

Average Annual Daily Traffic

Table 7-17 shows the Average Annual Daily Traffic count (AADT) on each of these routes and the estimated increment on each route's AADT from the addition of eight tanker trucks delivering product to the Millbank TGS. This table indicates that the contribution of tanker trucks to the total traffic on the alternate highway routes which could be used is generally less than one percent and in most cases is less than one-half of one percent. These small percentage increments in AADT could be further reduced by distributing the daily truck trips over the several alternative routes available.

Given the relatively small increment in AADT provided by the sixteen daily truck trips, it can be seen that this contribution to the overall congestion of the highway network is slight. Potential problems of congestion can be diminished by first distributing the truck trips over alternative routes, and second by operating during the night-time rather than in peak daylight hours. This latter operating sequence may be infeasible due to the noise generated by these trucks along the highway.

The overall effects of ten trucks (20 trips) per day transporting fuel are similar to those for eight trucks (16 trips) per day. The tanker truck contribution to the AADT for ten trucks per day are shown in Table 7-18.

TABLE 7-17

Tanker Truck Contribution to AADT Year Round Transport

	Route	1988 AADT	Tanker Truck Contribution (%)
From Saint John	7 to Fredericton	3,020 (Permanent)	0.4
	8 to Chatham	2,040 (Permanent)	0.6
	11 to Millbank	3,350 (Temporary)[1]	1.0
	1 to Sussex	5,560 (Permanent)	0.2
	2 to Moncton	7,450 (Permanent)	0.2
	126 to Chatham	1,660 (Permanent)	0.7
	15 to Shediac	12,700[2] (Temporary)[1]	0.3
	11 to Chatham	2,390 (Permanent)	0.5
	11 to Millbank	3,350 (Temporary)	1.0
From Dartmouth	2 to Moncton	9,700 (Permanent)	0.1
	126 to Chatham	1,660 (Permanent)	0.2
	15 to Shediac	12,700[2] (Temporary)[1]	0.3
	11 to Chatham	2,390 (Permanent)	0.5
	11 to Millbank	3,350 (Temporary)	1.0

---

[1] 16 truck trips per day x 5/7 = 11.4 Average Daily Trips
AADT counts at temporary counters based on one count per two axles, tanker truck has an average of six axles - AADT count 11.4 x 6 ÷ 2 = 34 AADT counts

[2] 1987 AADT

Source: New Brunswick Department of Transportation

TABLE 7-18

Tanker Truck Contribution to AADT, April to November Transport

	Route	1988 AADT	Tanker Truck Contribution (%)[1]
From Saint John	7 to Fredericton	3,020 (Permanent)	0.5
	8 to Chatham	2,040 (Permanent)	0.7
	11 to Millbank	3,350 (Temporary)	1.3
	1 to Sussex	5,560 (Permanent)	0.3
	2 to Moncton	7,450 (Permanent)	0.2
	126 to Chatham	1,660 (Permanent)	0.9
	15 to Shediac	12,700[2] (Temporary)	0.3
	11 to Chatham	2,390 (Permanent)	0.6
	11 to Millbank	3,350 (Temporary)	1.3
From Dartmouth	2 to Moncton	9,700 (Permanent)	0.1
	126 to Chatham	1,660 (Permanent)	0.9
	15 to Shediac	12,700[2] (Temporary)	0.3
	11 to Chatham	2,390 (Permanent)	0.6
	11 to Millbank	3,350 (Temporary)	1.3

---

[1] 20 trips per day x 5/7 = 14.3 Average Daily Trips
AADT counts at temporary counters based on one count per two axles, tanker truck has an average of six axles - AADT count 14.3 x 6 ÷ 2 = 43 AADT counts

[2] 1987 AADT

Source: New Brunswick Department of Transportation

Level of Service

As shown above, the transport of fuel will result in a maximum of 10 round trips per day, or approximately one trip in each direction per hour. This is a very modest increase in traffic load. A level of service analysis was completed for two sample sections of the proposed route:

- Route 11 from the intersection of Routes 8 and 11 to McHardy Road; and
- Route 8, control section 4 near Taymouth.

The section of highway on Route 11 was chosen because of its proximity to the Millbank site and because its physical characteristics are typical of most of the proposed route. The control section on Route 8 was chosen to demonstrate the effect on level of service of the fuel transport on a section of highway where the impact is expected to be greater than average. The calculation of level of service for each section is shown below in Table 7-19.

The practical capacity is equal to the service volume at the bottom of level of service C. The current demand in both cases, therefore, is much lower than the practical capacity. The impact of two trucks per hour (one round trip in each direction per hour) is equivalent to 10 passenger cars per hour (2 trucks x 5 passenger car equivalents). The additional traffic generated by the transport of fuel does not pose a capacity problem along these sections of highway and therefore will probably not be a problem along any of the proposed routes. In addition, the need for a "build sooner" analysis is not warranted since the capacity will not be reached for quite some time in the future.

TABLE 7-19

Capacity Calculations

	Route 11, near Millbank	Route 8, near Taymouth
Current AADT	3,300 veh./day	2,600 veh./day
30th highest hourly traffic	14% of 3,300 = 462 veh./hr.	14% of 2,600 = 364 veh./hr.
Current Peak Hour Demand	462 veh./hr.	364 veh./hr
Posted Speed limit	ranges from 50 to 80 km/hr	ranges from 50 to 90 km/hr
Level of Service C/D is appropriate in both cases for this analysis.		
v/c ratio	0.70	0.47 (rolling terrain, 15% no passing, average speed 80 km/hr)
width factor (W)	1.0	1.0 (average lane with 3.75 m, shoulder width 1.75 m)
% Trucks	10 %	8.9 %
Passenger Car Equivalent (E_T)	5	5
Truck Factor (T)	0.71	0.74
Service Volume (SV) SV=2000 x v/c x W x T	994 veh./hr.	696 veh./hr.

Road Conditions

All highway sections along the proposed route are arterial class highways and are in good condition. The trucks to be used are triple axle tractor trailer units. These trucks have a gross vehicle weight (GVW) of 39,600 kg. Each rig has 13 equivalent single axle loads (ESAL). Based on ten trips per day, the highways will carry 130 ESALs per day, 260 days per year for a total of 33,800 ESALs per year. These highways have good surfacing with good subgrade deflection values, i.e. $w < 0.635$ (RTAC Pavement Management Guide). Therefore, the loss in riding comfort (RCI) is negligible as a result of the transport of fuel to the Millbank TGS.

It is assumed that traffic will travel Route 11 to reach the Millbank TGS. The lower part of the McHardy road will be upgraded to accomodate heavy truck traffic. Route 8 is being realigned to the north of the site. There is a long term plan for an interchange with the newly aligned Route 8 just west of the the McHardy Road to connect the new alignment of Route 8 and the future Newcastle-Douglastown By-pass, but it is not known when this will be constructed.

Safety Analysis

The impact of the transport of fuel on highway safety is based on the potential number of tanker truck accidents per million kilometres travelled. It is estimated that a one way trip between Saint John and Millbank is approximately 300 km, and from the New Brunswick/Nova Scotia border is approximately 200 km. Based on a total of 4,160 one way trips per year, the exposure levels on New Brunswick highways will be 1.248×10^6 vehicle km per year from Saint John and 0.832×10^6 vehicle km per year for shipments from Dartmouth. A 1988 study (Sparks et. al.) on truck safety in Saskatchewan estimates an accident rate of 0.71 accidents per million vehicle kilometres for large trucks. Table 7-20 shows the accident statistics for Saskatchewan in 1986.

TABLE 7-20

1986 Saskatchewan Highway Traffic Accidents

	Total Accidents	Truck Accidents	Percent
Property Damage Only	26,754	775	81.2 %
Personal Injury	5,760	162	17.0 %
Fatal	185	18	1.9 %
Total	32,699	955	100 %

Source: Sparks et. al., Safety Experience of Large Trucks in Saskatchewan, 1988.

The accident involvement rate of trucks travelling on New Brunswick highways is approximately the same as in Saskatchewan, the above figures may be used to estimate the number of accidents on New Brunswick highways resulting from the transport of fuel. From the above figures, it is estimated that for delivery from Saint John, there will be 0.88 accidents per year, or 8.8 accidents every 10 years of which 7.1 will involve property damage only, 1.5 will involve personal injury and 0.167 will be fatal. It is estimated that there will be one fatal accident every 60 years assuming the above accident rate of 0.71 does not change. Similarly, for transport from Dartmouth, it is estimated that there will be 0.59 accidents per year on New Brunswick highways or 5.9 accidents every 10 years including 4.8 involving property damage only, 1.0 involving personal injury and 0.11 fatal accidents. It is estimated that there will be a fatal accident every 89 years, assuming there is no change in the accident rate over this period.

The above calculations were based upon figures for all large trucks. In comparison, the same study estimates the accident rate for all vehicles in Saskatchewan to be 0.81 accidents per million vehicle kilometres. In addition, the accident rate for all vehicles on the Interstate Highway System in the United States is estimated to be 0.76 accidents/million vehicle kilometres (D. Mason, pers. comm.).

The accident rate for tanker trucks is expected to be less than that for all large trucks since tanker truck drivers often have more training and exercise greater caution due to the hazardous nature of much of the material they carry. The North American average accident rate for tanker trucks is approximately 0.13 accidents/million vehicle kilometres. A major New Brunswick carrier has indicated that its accident rate is 0.052 accidents/million vehicle kilometres. Based on this accident rate, the potential number of accidents for fuel transport from Saint John is 0.065 accidents every 10 years, and 0.04 accidents every 10 years from Dartmouth. This carrier has won three international safety awards in recent years, which will partially account for the much lower accident rate (C. Little, pers. comm.).

The above estimate of accidents is based upon the contribution to the overall traffic level of the trucks. In addition, the trucks travelling on Route 11 will be required to make a left turn from the Route 11 eastbound lane onto the McHardy Road. Any left hand turning movement on a primary highway, particularly by large trucks, will increase the risk of an accident. This section of Route 11 is a relatively safe intersection because the highway is level and straight. There is, therefore, sufficient turning and crossing sight distances for left turn movements. The addition of a left turn lane would increase the safety at the intersection, however the number of trucks involved does not warrant the construction of a turn lane at this intersection.

Accidental Spills

Table 7-21 shows the number and amount of accidental spills from oil trucks in the Province over a four year period from 1986 to 1989. On average throughout the Province, there were 31 accidental spills per year. Each spill created an average leakage of 427.9 gallons of fuel. Information on the total number of tanker trucks registered in New Brunswick, required to determine a risk factor, was not available at the time of writing.

Water Supply Areas

The only known municipal surface watershed traversed by the potential tanker truck routes is the Carpenter's Road watershed, serving the Town of Rothesay. Route 1 passes through the watershed approximately 15 km northeast of Saint John. Groundwater supply areas have not been accurately delineated along the potential transportation routes, however the potential routes do pass near the municipal wells for the following municipalities (D. Pupek, pers. comm.):

Route 1	Sussex
Route 2	Moncton

TABLE 7-21

Accidental Oil Spills from Tanker Trucks

Year	Number of Spills	Amount Spilled (gallons)
1986	22	6,429
1987	6	3,069
1988	31	12,489
1989.	65	30,077

Average number of spills: 31
Average amount spilled: 427.9 gallons

Source: New Brunswick Department of the Environment, Environmental Emergencies Report (pers. comm. 1990)

Route 7	Fredericton
Route 8	Chatham, Douglastown, Newcastle, Doaktown
Route 11	Bouctouche, Richibucto, Chatham
Route 126	Chatham

The provincial Department of the Environment is currently drafting Designation Documents which contain development guidelines aimed at controlling activities in the surface and groundwater watersheds which provide drinking water for municipalities. These guidelines address the transport of dangerous/hazardous materials within the watershed boundaries. Notwithstanding those initiatives, in the case of accidents and other upset conditions, each situation is evaluated and handled on a site specific basis.

Diesel fuel is classified as a hazardous substance under the Transportation of Dangerous Goods Act, thus care must be taken by the tanker truck operators to abide by the appropriate regulations regarding their operations in these sensitive areas.

7.6.2 Control Measures

It does not appear that a left turn lane will be needed at the intersection of Route 11 and the McHardy Road. However, the only way to verify this is to conduct a count of left-turning vehicles at this intersection.

7.6.2.1 Design Regulations

Design regulations in the 1985 National Fire Code of Canada, Regulation 87-97 under the New Brunswick Clean Environmental Act and the Environmental Codes of Practice are designed to reduce the impact of plant construction and operation on the environment. NB Power will take the appropriate measures to satisfy these requirements during the design, construction and operation of the power plant. Of particular significance on-site is the dyked and lined containment area around the storage tanks intended to prevent movement of an accidental spill to the soil, surface water and groundwater of the surrounding environment.

7.6.2.2 Contingency Plans

There is potential of environmental damage from the accidental spillage of No. 2 diesel fuel from delivery to the Millbank TGS. To minimize the possible adverse effects on the environment of such a spill, NB Power has developed a Contingency Plan to deal with such an emergency situation. The Plan, presented in Appendix C of this report, includes guidelines for the reporting of the spill, training procedures, resource allocation, and the supervision of clean-up, containment and restoration procedures.

The purpose of a contingency plan (Appendix C) is to be able to initiate an immediate response with trained personnel and equipment to remove an accidental spill and ensure minimal impact to the land or marine environment in the immediate and surrounding area.

The plan has been developed in accordance with:

- the Emergency Response Assistance Plan from the Transport Dangerous Goods Directorate (Transport Canada, 1988);
- the Nova Scotia Department of Environment Contingency Plan Criteria;
- the New Brunswick Petroleum Product Storage and Handling Regulation 87-97; and
- the National Fire Code of Canada 1985.

Guidance has also been provided from:

- NB Power's general operations and maintenance procedure No. 42;
- New Brunswick Department of Environment; and
- Environment Canada.

Because timely and accurate reporting of an accidental diesel spill can help to ensure quick and efficient response by proper authorities, the plan includes detailed information regarding both general and specific notification procedures. Systematic reporting procedures have been developed to enable drivers to properly communicate relevant information about the spill, including the location, source, volume and type of spill, to the appropriate internal and external authorities. In addition, the Contingency Plan outlines procedures for notifying and updating the news media.

As stated in the Plan, employees participating in clean-up operations will be trained in emergency operations and safety procedures as outlined in NB Power's General Operation and Maintenance Procedure No. 42. The Plan also describes training procedures, such as simulation exercises, to be used in preparing employees for emergency operations.

Procedures for clean-up, containment, disposal and monitoring, including details regarding equipment and personnel allocation, are also presented. Finally, the Plan contains policies for restoring the contaminated site to its previous state and for dispensing compensation in the event of damages, so that there will be no financial loss to third parties as a result of an accidental spill.

The final plan will be customized to make it site specific, and will be distributed to all personnel potentially involved in clean-up operations. A copy will be available where the equipment is stored or where personnel will gather to receive information on the magnitude, location and type of spill and instructions on the plan of action. The plan will contain:

- Table of Contents;
- Contact list for internal and external notification;
- List of response personnel and their responsibilities;
- List of communication equipment and identified users;
- Logistic plan to acquire equipment, support personnel and supplies which includes numbers, personnel and equipment available at other internal, industrial and government sources;
- Plan of action for various response scenarios (all practised in simulation exercises);
- Media contact;
- Other emergency contacts (government agencies, police, hospitals, fire department, etc.);
- Monitoring and restoration plans;
- Disposal plans;
- Report filing;
- Maintenance plan for equipment;

- Record of amendments, and
- List of all plan holders.

Environment Canada has established a committee in the Atlantic Region to respond to environmental emergencies, and to provide coordinated and comprehensive advice on environmental emergency planning and response. The Regional Environmental Emergency Team (REET), includes representatives from various concerned government agencies and industries. REET normally comes into play in the events of major spills, such as those which might occur in a coastal area as a result of a marine transportation incident. It is not expected that REET would become involved in a single tanker truck spill incident on a provincial highway. REET would be advised in the event of an on-site storage tank failure, even though the design of the storage facilities will ensure containment of a resultant spill on site.

7.6.3 Residual Effects

If contaminated soil and groundwater occurs as a result of an uncontained spill, NB Power will be responsible for removal or treatment of contaminated soil and the mitigation of groundwater contamination by decontaminating the water or replacing the local water supply with either new wells or an alternate source.

7.7 Wastewater Effluent

The neutralized and particles-free overflow from the sedimentation pond will be discharged into the Miramichi River at a location near the existing Millbank wharf. This effluent (Table 3-1), containing a total dissolved solids concentration of approximately 400 mg/L, will have no effect on the water quality in the Miramichi River, and thus is not considered to be of concern with respect to fish or other aquatic resources.

CHAPTER EIGHT

DECOMMISSIONING AND ABANDONMENT PHASE

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8.0 DECOMMISSIONING AND ABANDONMENT PHASE

The combustion turbine power plant will have an economic lifetime of at least 20 years. Thereafter, the generating station may remain in operation by appropriate refitting or it will be decommissioned and the site "abandoned" by NB Power.

If the site is to be abandoned, the power plant will be decommissioned in accordance with the "Environmental Codes of Practice for Decommissioning" which are currently being finalized by Environment Canada for application to steam electric power generation stations in Canada.

The objective of decommissioning will be to return the site to a state for which future land uses are not restricted by environmental concerns. The design of the proposed plant, and its operation, will be consistent with this objective. Thus, all potential sources of contaminants will have been catalogued prior to construction of the power plant. This factor, combined with routine monitoring and vigorous inventories of all fuels and other chemicals during the operating phase, will ensure a fully "known" situation at the time of decommissioning.

Decommissioning will involve several phases, as follows:

1. an audit of the plant site to catalogue the status of all facilities and related lands, particularly with respect to the presence of contaminants;

2. decontamination, where necessary, and removal of hazardous and potentially hazardous substances (i.e., fuels, lubricants, residual chemical supplies, sludges) to other users or hazardous waste disposal facilities;

3. removal of all "inert" materials (i.e., building materials, tanks, pipelines, etc.) and equipment to scrap dealers and other recyclers;

4. infilling of all ponds and other excavated areas, and

5. final contouring and vegetation of the area, including access roads.

The decommissioning work would be followed by a close-out audit of the site to certify the acceptability of the area for abandonment by NB Power without restrictions on future uses caused by environmental concerns.

Details of a decommissioning plan will be developed in advance of a decision to close the facility, and will respond to the Codes noted above, and to other current standards. At the present time it is envisaged that the end use of the site will be a "greenfield" condition similar to the condition existing at the site now.

CHAPTER NINE

MONITORING PROGRAM

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9.0 MONITORING PROGRAM

9.1 Construction Phase

The site will be routinely inspected to ensure compliance with all requirements indicated in this EIA report or otherwise specified by the regulatory agencies. In particular, noise measurements will be carried out on a routine basis throughout the construction phase to provide a basis for control and further actions, if necessary. Also, the hydrostatic test for the fuel storage tanks will provide an opportunity to monitor the response of the groundwater system to withdrawals.

9.2 Operating Phase

Fuel Storage System

The fuel storage system will be monitored to ensure compliance with all provisions in the New Brunswick Clean Environment - Petroleum Product Storage and Handling Regulation, 87-97. Liquid levels will be verified on a continuous basis and reconciled with product input and consumption. All piping is isolated by secondary containment and alarmed for the detection of fuel leaks. This, in effect provides a continuous monitoring system of the fuel storage and piping facilities.

Air Quality

Regular monitoring will be undertaken to ensure that the NO_x control system is effective, through sampling ports built into each unit stack.

Water Quantity and Quality

Test drilling has indicated that water quantities of nearby residential wells will not be affected even under extreme operating conditions (six 16 hour days of operation or 48 consecutive hours). Piezometers will be situated between NB Power wells and residential wells to ensure that critical drawdown will not occur. Additional wells will be drilled if necessary.

Most nearby wells were sampled and analyzed in March 1990 to determine background quality. NB Power will continue to monitor the wells on a regular basis.

Liquid Effluents

All effluents discharged from the site will be monitored on a routine basis to ensure compliance with regulatory requirements. These requirements are expected to be similar to those currently in effect at the Chatham Generating Station. Toxicity testing will also be conducted.

Noise

Noise surveys will be undertaken during the initial periods of power plant operation to ensure compliance with the source and receptor sound levels defined in this report.

CHAPTER TEN

PUBLIC CONSULTATION

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10.0 PUBLIC CONSULTATION

During the course of the Environmental Impact Assessment (EIA), NB Power has actively met with and consulted those who might be affected by the construction and operation of the proposed Millbank TGS. The objectives of this process were to ensure:

- that affected parties are well informed on all environmental and socioeconomic costs and benefits of the project;
- that public concerns were reflected in the EIA process; and
- that the values and concerns of the public were adequately addressed and incorporated in the study.

In order to accomplish these objectives, NB Power conducted formal and informal consultation with concerned members of the public. A summary of the consultation process follows.

10.1 Visit to Michigan TGS

The NB Power Millbank TGS project manager and the Vice-President of Engineering and Construction for NB Power accompanied the Chairperson and Vice-Chairperson of the Millbank Residents Committee to a combustion turbine project in Midland, Michigan. The plant visited was a 12 unit gas turbine combined cycle station capable of producing 1370 MW, fuelled by natural gas. The objective of the visit was to familiarize the Committee members with the combustion turbine technology in an operational setting, so that some appreciation of this type of generation might be obtained. It was recognized that the setting and the station were not identical to the proposed Millbank facility; for example, the combined cycle aspect of the units create higher noise levels than will the proposed Millbank units. Nonetheless, it was considered that the similarities outweighed the differences in helping to understand the workings and implications of the proposed project. Following the trip, the Committee representatives met at NB Power offices in Fredericton with project team members and with the Director of Environmental Affairs for NB Power.

10.2 Public Information Meeting, Millbank March 27 1990

NB Power held a public information meeting in Millbank on 27 March 1990 in order to discuss project concepts which might be helpful to the public in considering the draft guidelines for an EIA issued for public review and comments on 1 March 1990. A number of NB Power representatives made presentations with the assistance of slides and panel displays regarding such aspects of the project as:

- the rationale for and benefits of the project to NB Power and its customers;
- the environmental review process;
- the significance of the EIA process within the overall project schedule;
- the objectives of the EIA component studies;
- such project related concerns as water usage, fuel delivery, operational noise, atmospheric emissions, and site selection.

NB Power indicated that the EIA component studies would address particular issues raised in the guidelines, but emphasized that no findings were yet available.

Approximately 90 to 100 individuals attended the meeting, in addition to NB Power staff. There was vigorous discussion of a number of the concerns noted above; because of the status of the studies, no answers were available to many questions from the floor related to issues raised in the guidelines. No issues were apparent which had not been anticipated in the draft guidelines.

NB Power made two commitments at this meeting:

i) once the draft EIA report was available and submitted to the NBDOE, NB Power would conduct another public information meeting to present the findings of the studies; and

ii) NB Power would make available to individual homeowners the analytical results of water well samples taken as part of the groundwater investigation.

10.3 Meeting with Millbank Residents' Committee, 9 April 1990

NB Power personnel, and consultants, have met with residents of the Millbank area on two separate occasions. Both meetings were informal evening sessions, held in the home of the Chairperson of the Millbank Residents Committee. The first meeting, on the 9th April, 1990, was concerned primarily with real estate issues and possible effects of the project upon property values; other issues similar to those discussed on 27 March were also discussed, but the focus was on property values. Many residents of the Rockcliffe subdivision were concerned that their properties would lose value. NB Power indicated that it had no evidence of this with other projects, and did not anticipate that it would happen with regard to the Millbank TGS. Nonetheless, measures to preserve investments in properties in the subdivision were discussed, and it was agreed that the Committee would present to NB Power what it be considered an acceptable procedure for ensuring that residents would not suffer financial damage as a result of the project implementation. (NB Power was later advised that the committee had decided not to put forward such a procedure).

10.4 Meeting with Millbank Residents' Committtee, 23 April 1990

The second meeting, held on 23 April 1990, was attended by NB Power's Director of Environmental Affairs, accompanied by representatives of WMS Associates Ltd., socioeconomic consultants. Discussion focused on the impact of the project on property values, water supply, aesthetics and the general quality of life in the area. Residents stressed that they were opposed to the project site, not to the project itself. NB Power stated that preliminary implications were that there was ample water supply to meet project requirements while maintaining the well supplies of nearby residents. NB Power committed to the residents of the subdivision that if the project were in any way responsible for water well problems, then NB Power would compensate for the loss of water by trucking in supplies until a permanent solution could be achieved by NB Power. Also NB Power offered to ensure property values by conducting pre-project appraisals of the subdivision homes in order to establish current market value, using at least two (2) independent appraisers, and guaranteeing this price plus an inflator and/or general area market escalator, in the event that residents wanted to sell at some time in the future.

The Committee requested that the Committee's request that alternate sites be reconsidered be related to NB Power senior management; specifically, locations on the other side of the new Route 8 right-of-way, and Crown land further north and west of the proposed site. A copy of the most recent site plan was requested. NB Power was requested to consider alternative siting and alignments on the land which it had optioned at that time.

10.5 Fredericton Meeting, 30 April 1990

NB Power's Millbank TGS project manager and the NB Power Director of Environmental Affairs met with the Chairperson of the Millbank Residents Committee in Fredericton on 30 April 1990. At that time the latest plans were transmitted to the Committee for information; it was indicated that there was little room for further realignment of the project facilities within the confines of the lands optioned to NB Power, due to topographic conditions. It was also emphasized that the requirements of the project schedule were such that it was not possible at this time to reconsider various alternative sites and still meet the in-service date for the project, and thus no further consideration would be given to the two sites suggested by the Committee on 23 April.

Where appropriate, concerns and information obtained by NB Power at these sessions was forwarded to the appropriate consultants to be addressed and incorporated in the study.

10.6 Meeting with Millbank Residents Committee, 05 June 1990

A third meeting was held with the Committee to present the findings of the draft EIA report. The meeting was attended by NB Power's Director of Environmental Affairs and its Manager of Real Estate, and by a representative of Maritime Groundwater Inc., hydrogeological consultants. At this time six (6) copies of the draft were left with the Committee for information and for review. The key findings of the study were discussed at some length, with the main discussion revolving around the predicted effect upon the watertable, and upon property values. NB Power also advised at this time that it had been successful in securing options on more land to the west so that the location of the facilities would be moved about 200 m westward and out of the direct line of sight by Rockcliffe Drive.

10.7 Public Information Meeting, 13 June 1990

A public information meeting was held to present the findings of the EIA studies in the church hall at Millbank. The meeting was sparsely attended, and there were two questions of clarification.

10.8 Information Booth, 14-16 June 1990

During the period 14-16 June 1990, NB Power operated an information booth at the Douglastown shopping mall complete with a scale model of the combustion turbine selected for the project. Information sheets were available summarizing the characteristics of the machine, the project and the key findings of the draft EIA. Between 400 and 500 individuals visited the information booth.

10.9 Other Meetings

NB Power has been, and remains, prepared to make presentations to interested parties such as municipal councils, service groups, and other organizations, upon request. To date, one such information meeting has been held, at NB Power's District Office in Chatham, for the benefit of NB Power staff in the area.

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APPENDIX A

MILLBANK COMBUSTION TURBINE PROJECT

CONSISTENCY WITH ENVIRONMENT CANADA'S ENVIRONMENTAL CODES OF PRACTICE FOR STEAM ELECTRIC POWER GENERATION - SITING PHASE

Criterion C101. Avoid areas which have prime agricultural capability on a regional scale.

In New Brunswick, prime agricultural land is designated as Class 2 and Class 3. Prime agricultural lands were determined from Canada Land Inventory maps (CLI). Based on these capability maps, there is no Class 2 or Class 3 agricultural land within a 5 km radius of the Millbank site. It was therefore concluded that the Millbank area is not considered a prime area for agriculture because of its land capability, and that the proposed Millbank site complied with the above Criterion.

Criterion C102. Avoid areas within or adjacent to blocks of intensively managed forest lands.

A 5 km radius is suggested in the Codes of Practice to protect intensively managed forest land including timber production-reforestation areas, tree nurseries, and research forests from damage due to plant site development. No such areas exist within 5 km of the site. There is a small Christmas tree plantation (about 17 ha) adjacent to the site, which will not be damaged due to plant site development. Thus, the Millbank bank site is considered to be an acceptable site with regard to this criterion.

Criterion C103. Avoid areas adjacent to relatively large designated or formally proposed Federal, Provincial or Regional parks.

The criterion is intended to protect areas with strong recreational values, or areas which have the capability to provide a high-class recreational experience to the visitor. It is suggested in the Codes of Practice that Federal, Provincial or Regional parks larger than 5 km^2 or longer than 5 km, if linear, be examined in Phase I, while smaller lands be deferred until Phase II. To protect these lands from site development a 5 km buffer zone is recommended in the Codes of Practice. there are no known designated or formally proposed Federal, Provincial or Regional parks larger than 5 km^2 within the suggested 5 km buffer radius around the proposed Millbank site. Thus, the site is consistent with this criterion.

Criterion C104. Avoid all federal, provincial and regional lands dedicated to the protection of flora, fauna and unique natural, historical and archaeological features.

For Phase I, it is suggested in the Codes of Practice that only dedicated lands larger than 5 km^2 be considered. Smaller dedicated lands will be considered in Phase II screening. There are no dedicated lands larger than 5 km^2 in the vicinity of the proposed Millbank site. Thus consistency with this Code criterion is ensured.

Criterion C105. Avoid all large wetlands or wetland complexes in Southern Canada.

There are no large wetlands or wetland complexes in the Millbank area. Thus, consistency with this Code Criterion is ensured.

Criterion C106. Avoid all known concentration areas of rare or endangered floral and faunal species, along with a buffer zone appropriate to the sensitivity of the individual species.

There are no known rare or endangered plant or animal species in the Millbank area, nor are there any species considered to be unusual. Thus, this site is consistent with this criterion of the Code.

Criterion C107. Avoid rare and endangered species habitat, other critical wildlife habitat including wildlife corridors, critical nesting areas and winter ungulate concentration areas along with a buffer zone appropriate to the sensitivity of the species.

There are no known rare or endangered species habitat in the immediate vicinity of the Millbank site, nor are there known wildlife corridors or critical nesting areas at or in the immediate vicinity of this site. Discussions with personnel of the Fish and Wildlife Branch of the Department of Natural Resources and Energy indicate the absence of deer or moose wintering years in the area. Therefore, the Millbank site is consistent with Criterion.

Criterion C108 - C111.

Siting Code Recommendations C108-C111 address issues associated with the potential effects of Cooling Water Systems upon the aquatic environment. The proposed project does not include such a system, and thus these recommendations are not applicable.

Criterion C112. Avoid areas of highly fractured bedrock.

The bedrock in the study area consists of sedimentary rocks (sandstone and shales) which lie in subhorizontal beds. These rocks are of Carboniferous Age on the geological time scale and extend across eastern and northeastern New Brunswick. Bedrock geology maps (Ball et al., 1902) indicated the presence of a fault system (the Catamaran fault) beneath the Miramichi River but do not indicate faults or fractures at the site. Examination of aerial photographs and topographic maps indicated the presence of linear features (potential fractures) which are typical of these Carboniferous rock units. These features are peripheral to the proposed development site. Thus, it is considered that the Millbank site is consistent with this Criterion.

Criterion C113. Avoid areas of thick, highly permeable sand and gravels.

The overburden in the Millbank area consists of 1 to 3 m of till which was deposited as a morainal sediment by glacial action (Rampton et al., 1984). This material typically consists of a poorly sorted mixture of sand, clay and boulders. This till would be expected to have significantly lower groundwater velocities than would be expected in other surficial deposits such as the sand and gravels associated with glaciofluvial outwash. This overburden cannot be considered to be either thick or highly permeable, and thus the proposed site is considered to be consistent with this Code Criterion.

Criterion C114. Avoid areas of major recharge which are upgradient to major groundwater users.

The proposed Millbank site is not itself a recharge area, and would be expected to recharge from the north. There are several private residences in the anticipated downgradient direction but there are no major large volume groundwater users downgradient. Thus, it is considered that the proposed Millbank site is consistent with this Criterion.

Criterion C115-C117.

Siting Code Recommendations C115-C117 address issues associated with the potential effects of Cooling Water Systems upon the aquatic environment. The proposed project does not include such a system, and thus these recommendations are not applicable.

Criterion C118-C119. Avoid areas adjacent to estuaries or coastal wetlands; avoid all salt marshes and salt marsh complexes.

The proposed Millbank site is on the estuary of the Miramichi River; there are no coastal wetlands or salt marshes or salt marsh complexes within the immediate vicinity of the site.

These criterion are intended to protect estuaries, coastal wetlands, and salt marshes from thermal effects, the effects of shipping when fuel is delivered by a water route, and the effects of blowdown and waste water discharge. In the case of the proposed Millbank project, there will not be a cooling water system and thus there will not be associated potential for thermal effects. Although fuel delivery by water was an important consideration early in the project planning, the preferred fuel delivery option is now by road transport; thus, there will be no potential effects associated with the delivery of fuel by water. Finally, liquid effluent will be controlled and treated to appropriate levels (i..e, New Brunswick Department of the Environment standards) and thus there does not appear to be a reason to avoid this site.

Thus, it is considered that the proposed Millbank site is consistent with these criteria.

Criterion C120. **Avoid areas close to the boundary of preserved national, provincial or other designated parklands or dedicated lands, and international borders.**

There are no preserved national, provincial or other designated parklands, or international borders close to the proposed site. The National Kouchibouguac Park is located some 47 km east and somewhat south of the site. The provincial Enclosure Park is located approximately 15 km to the west and somewhat south of the proposed site. An Ecological Reserve has been proposed at Blacklands, some 50 km to the east and north at the mouth of the Tabasintac River although this has not been proclaimed by the Province. Portage Island at the mouth of the Miramichi estuary about 35 km east of the site, is a National Wildlife Area. The nearest international border is 180 km.

Site specific atmospheric dispersion modelling has demonstrated that atmospheric emissions from the proposed facility would not impact upon any of the areas identified. That is, maximum predicted Ground Level Concentrations of SO_2, NO_x and particulates were all well within provincial standards, and occurred within 5 km of the proposed site.

Therefore, it is considered that this site is consistent with Criterion C120.

Criterion C121. **Avoid areas where existing air quality is near or exceeds national or provincial air quality objectives, criteria and/or regulations.**

Current background wet deposition levels are in the range of 9.9 to 15.9 kg SO_4/ha/y with the middle of the range (12.9 kg SO_4/ha/y) selected as a typical level. Wet deposition data for Harcourt were used in inferring background levels. A wet sulphate deposition level of 20 kg SO_4/ha/y has been suggested as being adequate to protect moderately sensitive lakes. For highly sensitive aquatic habitat, wet sulphate deposition levels of about 14 kg SO_4/ha/y have been cited as being sufficiently low to prevent deterioration. The background levels at Millbank were found to be lower than the recommended values to protect moderately and highly sensitive areas, and modelling demonstrated that the facility proposed at this site would not significantly increase those levels. Thus, it is considered that this site is consistent with this Code recommendation.

Criterion C122. **Avoid locating stations near large urban centres.**

There are no large urban centres (40,000 people or more suggested in Codes of Practice) within a 50 km radius of the proposed Millbank site. The largest urban centre in the area is Chatham with a population of approximately 6,000 people. Thus, the site is consistent with this criterion.

Criterion C123. **Avoid areas with poor atmospheric dispersion characteristic due to the influence of terrain features.**

The proposed Millbank site is located in gently rolling landscape away from any terrain features which may cause poor plume dispersion. Wind data analysis of the Millbank site indicated that plume dispersion would not cause air quality concerns. Thus, the Millbank site is consistent with this Criterion.

Criterion C201. Evaluate areas within or adjacent to candidate sites for their agricultural capability and current productivity.

The soil capability for agriculture within the 5 km radius around Millbank ranges from Class 3 to Class 5. In New Brunswick, prime agricultural land is designated as Class 2 or Class 3 (CLI maps). The agricultural capability in the Millbank area is considered to be limited; there is no Class 2 land and an estimated 25% of the total land within a 5 km radius is Class 3. The remaining land area is divided between Class 4, 5, and 7. There is no Class 2 or 3 on the site itself. Thus, the site could be considered to be somewhere between the "intermediate" and "optimum" categories proposed in this Code recommendation.

Criterion C202. Evaluate areas surrounding candidate sites for their sensitivity to atmospheric emissions.

The majority of the agricultural land is small scale mixed farming. With only 21, 167 ha cleared out of a total 202,515 ha of agricultural blocked land in the whole of Northumberland County only a small portion of the cleared land would likely be dedicated to crops sensitive to SO_2 emissions. In any event, the SO_2 emissions associated with the proposed facility are negligible and are not expected to have an effect upon local agriculture. Thus, the proposed Millbank site complies with this criterion.

Criterion C203. **Evaluate areas in the vicinity of candidate sites for their forestry potential.**

The forest production and potential for future production in the Millbank area (5 km radius) were indirectly measured using the land capability for forestry as suggested in the Codes of Practice. Only Class 4 and 5, which presents moderately severe to severe limitations to the growth of commercial forest, are found in the area. Using the preference developed in the Codes of Practice as a basis to evaluate the proposed Millbank site. An optimum site for on-site development is defined as one where Classes 3 and 4 (prime forestry land in New Brunswick) exist. These classes are not present within a 5 km radius. Millbank, therefore, can be considered an optimum site with respect to forestry, and thus complies with this Criterion.

Criterion C204. **Evaluate areas in the vicinity of candidate sites for their production of tree species sensitive to atmospheric emissions.**

The sensitive tree species were determined using susceptibility lists which have been developed by several investigators (USEPA, 1973, Phillips et al., 1975; Linzon, 1978: Environment Canada, 1987). Areas of sensitive tree species within the 50 km radius represent approximately 50% of the total land area. This represents, however, the worst case scenario as this percentage is based on land area only and not on the total 50 km area suggested in the Codes of Practice (i.e. land and water areas). According to the gradients of preference developed in the Codes of Practice, Millbank falls into the intermediate category for SO2 as less than 50% of SO^2-sensitive commercial tree species are found within 50 km of the candidate site.

In order for a location to be an optimum site, no SO_2-sensitive tree species must be found within 50 km of the site. This situation is practically impossible in provinces such as New Brunswick where mixed forest areas are important. In any event, the SO_2 emissions associated with the proposed facility are negligible, and are not expected to have an effect upon local forest species. Thus, the Millbank site is consistent with this Criterion.

Criterion C205. **Avoid all recreation areas not previously mapped in Phase I.**

Phase II screening only considers areas smaller than 5 km^2 (see Phase I C103). No recreational areas (less than 5 km^2) are found within a 5 km radius of the Millbank site. Thus, the proposed Millbank site is consistent with this Code Criterion.

Criterion C206. Evaluate recreation areas adjacent to candidate sites for their recreation capability and use.

Most of the recreational lands in the 5 km radius around Millbank area are classified as Class 6 except for a small area along opposite banks of the Miramichi River classified as Class 3. Lands in Class 6 have low capability for outdoor recreation while lands in Class 3 have moderately high capability. The development will not have an impact on these Class 3 lands due to their position across the river. To be an optimum site, Class 1 and 2 recreation lands should not be present within 5 km of the candidate site. Millbank site falls into that category.

The other concern associated with this criterion is the impacts of the facility on the quality of the recreational experience (aesthetics, loss of wilderness values, damage to the environment). This is assumed to occur up to 50 km from the site. All recreational values of importance (i.e. Class 1 to 3) occur along the coastline. The recreational values inland are limited to Class 4, 5 and 6. Class 4 and 5 are only found along water courses. Recreational experience in the area is limited to the coastline, lakes and rivers. These areas could be subject to visual impact. However, because of the small site area (23 ha) the development of the proposed plant is not expected to further infringe upon the area's recreational capability and use, particularly since existing uses upon these lands which NB Power accumulates at site but which are outside the development area will be allowed to continue.

Criterion C207. Evaluate areas in the vicinity of candidate sites for their level of hunting and trapping activity.

Trapping and hunting occur sporadically in the area surrounding the Millbank site. Trapping is a very minor component consisting largely of snowshoe hare sets. Although big game occurs along the present transmission line near the site and upland birds are hunted in the mixed habitat the area is not known to be exceptional when compared to other areas nearby. Within the 5 km radius the land is classified as Class 3 for ungulate capability. Using the Codes of Practice preference criteria the site falls into the intermediate classification.

Criterion C208. Avoid all dedicated ecological lands not previously mapped in Phase I, along with a buffer that relates to the sensitivity of the resources being protected.

Phase II screening only considers lands smaller than 5 km^2 as previously stated in Phase I (i.e. Criterion C104). It is recommended in the Codes of Practice that all dedicated ecological lands be surrounded by a buffer zone for which the size will reflect the sensitivity of each site. There are no dedicated lands within the 5 km radius suggested by the Codes of Practice and therefore the compliance with this criterion is met.

Criterion C209. Evaluate dedicated ecological lands in terms of their proximity to candidate sites and their potential for impacts from emissions and disturbance from ancillary developments.

This criterion demonstrates concern for the potential effects of power plant operations on dedicated ecological lands (e.g., atmospheric emissions from fossil fuels) as well as the effects of ancillary development. According to the Codes of Practice, these lands could be subject to such impacts at a distance of 50 km. The proposed Blacklands ecological reserve is located at the periphery of the 50 km radius proposed by the Codes of Practice. This ecological reserve has not been proclaimed, but it would be desirable to protect it as it represents a particular ecosystem of interest.

Also, the Portage Island National Wildlife Area, a distance of some 35 km from the site, is owned and managed by the Canadian Wildlife Service on behalf of the Government of Canada for the protection of important wildlife habitat, in this case, migrating waterfowl and particularly Osprey and Great Blue Heron. All infrastructure associated with the construction of the Millbank power plant are well within the 5 km radius where no dedicated ecological lands are found. Further, model studies indicate that atmospheric emissions will not impact upon these areas. By using the gradients of preference developed in the Codes of Practice, the Millbank site falls into the intermediate category.

Criterion C210. Evaluate the importance of wetland or wetland complexes close to a candidate site.

There are no wetland or wetland complexes close to the site. The site complies with the Codes or Practice for this Criterion.

Criterion C211. Evaluate the proximity of candidate sites to areas containing rare, endangered or regionally-significant species.

There are no known rare or endangered plant or animal species within 5 km of the site. The site complies with the Code for this Criterion.

Criterion C212. Evaluate the proximity of candidate sites to significant wildlife habitat not previously mapped in Phase I.

There is no significant wildlife habitat on or near the Millbank site. Using the preference classification of the Codes of Practice, the site can be considered optimum.

Criterion C213 - C215. **Evaluate the percentage of mean monthly river flow or percentage of lake (or closed bay) volume required for withdrawal or discharge at a given site.**

These code recommendations address issues associated with the potential effects of cooling water. The proposed Millbank project does not include such a system and therefore these criteria are not applicable.

Criterion C216. **Evaluate local bedrock and overburden.**

The bedrock in the study area consists of sedimentary rocks (sandstone and shales) which lie in subhorizontal beds. These rocks are of Carboniferous Age on the geological time scale and extend across eastern and northeastern New Brunswick. Bedrock geology maps (Ball, et al., 1902) indicate the presence of a fault system (the Catamaran fault) beneath the Miramichi River but do not indicate faults or fractures at the site. Typical groundwater velocities in these rock units are dependant on fracture density (secondary permeability) and thus will likely vary spatially. Hydraulic conductivity for the sandstone bedrock in the area varies from 0.4 to 4 m/d (Groundwater Resources in the Chatham Area, NB; Environment New Brunswick, May 1976). Assuming a hydraulic gradient of 2%, and a conservative porosity value of 5%, the groundwater velocity could range from 0.16 to 1.6 m/d. High velocities would be expected in the vicinity of fracture systems and these would represent target locations for sources of groundwater. Examination of aerial photographs and topographic maps indicate the presence of linear features (potential fractures) which are typical of these Carboniferous rock units. These features are peripheral to the actual development site and should not represent a constraint to development.

The overburden in the Millbank area consists of 1 to 3 m of till which was deposited as a morainal sediment by glacial action (Rampton, et al., 1984). This material typically consists of a poorly sorted mixture of sand, clay and boulders. This till would be expected to have significantly lower groundwater velocities than would be expected in other surficial deposits such as the sand and gravels associated with glaciofluvial outwash. Slug testing throughout the Province on similar till deposits yielded hydraulic conductivity values ranging from 8×10^{-2} to 8×10^{-6} m/d. The groundwater velocity will depend on the natural head present. Assuming an average head of 2%, groundwater velocities would range from 5×10^{-7} to 5×10^{-3} m/d.

The Millbank location would be expected to recharge from the north. There are several private residences in the anticipated downgradient direction but there are no major large volume groundwater users.

Criterion C217. **Evaluate groundwater directions and gradients by checking local relief.**

This evaluation is discussed in the documentation for Criterion C216 above.

Criterion C218. **Evaluate available well records and establish ground water quality.**

Ground water chemistry, including chemistry of water from domestic wells, was investigated. Fifty area homes that have independent ground water supplies from wells or springs were sampled. Water samples were classified according to the major ions present. About a third of the domestic wells contained manganese levels higher than the Canadian Drinking Water Guidelines and about 12% contained iron levels higher than the standard. Nitrates were also high in some wells. All wells sampled were of bicarbonate type.

Criterion C219 - C222. **Evaluate the proximity of sites to fisheries or spawning grounds previously undetected or not mappable on a regional scale.**

As with C108-C111 these criteria are concerned with water withdrawal and discharge. As this proposal does not include these facilities these criteria do not apply.

Criterion C223. **Examine existing air resources and pollution sources around candidate areas or sites to determine if the addition of a new power plant will still permit compliance with ambient air quality objectives and/or standards.**

The existing sources and their emission rates in the Millbank Airshed have been documented. The Millbank facility, due to the location and the nature of its equipment and fuel, will have a negligible effect upon the airshed. It will not contribute to any exceedences which might occur in the local airshed. As a result ambient air quality objectives will be maintained in the area immediately affected by emissions from the proposed site.

Criterion C224. **Evaluate available meteorological data to determine if there will be high air pollution potential due to unfavourable meteorological conditions at a candidate site or area.**

Meteorological data from the nearby CFB Chatham were used to determine air pollution potential due to unfavourable meteorological conditions. No dispersion problems were identified as the result of unfavourable meteorological conditions.

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APPENDIX B

APPLICATION OF "ENVIRONMENTAL CODES OF PRACTICE FOR STEAM ELECTRIC POWER GENERATION" DESIGN PHASE

TO

MILLBANK COMBUSTION TURBINE PROJECT

TABLE B-1

Application of Design Phase Guidelines

Guideline Number	Subject	Application
R101	Cooling Water withdrawal	Not applicable - withdrawals of water to provide cooling requirements will not be required
R102	Auxiliary cooling water withdrawal	Not applicable - as above
R103	Cooling water pumping system	Not applicable - as above
R104	Scheduling of station outages re cooling water intakes	Not applicable - as above
R105	Cooling water intake location	Not applicable - as above
R106	Cooling water outfall	Not applicable - as above
R107	Cooling water intake design	Not applicable - as above
R108	Cooling water intake at shoreline	Not applicable - as above
R109	Cooling water intake design	Not applicable - as above
R110	Selection of cooling water pumps	Not applicable - as above
R111	Cooling water system fouling control	Not applicable - as above

.....continued/

TABLE B-1 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
R112	Cooling water system scale and siltation control	Not applicable - as above
R113	Cooling water discharge temperature criteria	Not applicable - as above
R114	Cooling water discharge zones	Not applicable - as above
R115	Cooling water outfall - location and design	Not applicable - as above
R116	Cooling water - supplementary cooling	Not applicable - as above
R201	Evaporative cooling system - materials and chemicals	Not applicable - as above
R202	Evaporative cooling system - design and operating conditions	Not applicable - as above
R203	Auxiliary cooling system - design	Not applicable - as above
R204	Selection of ash handling system	Not applicable - ash will not produced by operation of the combustion turbine
R205	Selection of FGD system	Not applicable - the combustion turbine will not require a flue gas desulphurization system

.....continued/

TABLE B-1 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
R206	Reuse of water	Not applicable - minimal demands for water will not allow for reuse. Majority of water used is discharged as vapour in exhaust of turbine units
R207	Design of ash disposal sites	Not applicable - plant will not generate solid (ash) wastes
R208	Waste liquids	Applicable - design of wastewater management will be in accordance with R208 (refer to Section 3.7)
R209	Containment facilities	Applicable - design of dyked areas and holding ponds will be in accordance with R209 (refer to Sections 3.4 and 3.7)
R210	Seepage Control	Applicable - design of seepage control facilities (ponds, storage areas) will be in accordance with R210 (refer to Sections 3.4 and 3.7)
R211	Treated water effluent quality	Applicable - all liquid effluents from the plant will meet the specified water quality limitations
R212	Radioactive wastewaters	Not applicable - plant will not generate radioactivity or use radioactive substances

.....continued/

TABLE B-1 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
R213	Treatment of Sanitary Wastewaters	Applicable - but not as proposed due to small number of staff members at site. Sewage treatment will consist of septic tank/ tile field system (refer to Section 3.7.1)
R301	Monitoring facilities - ease of access	Applicable - will be designed to ensure accessibility
R302	Once through cooling - continuous monitoring	Not applicable (refer to R101)
R303	Once through cooling - periodic monitoring	Not applicable - as above
R304	Discharged effluents - monitoring	Applicable - flow and water quality will be monitored on routine basis
R305	Inplant monitoring	Applicable - monitors will be specified during design phase to meet process requirements
R306	Monitoring of coal and ash storage area groundwaters	Not applicable - coal and ash will will not be present at the site

.....continued/

TABLE B-1 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
R307	Groundwaters - pre-operational monitoring	Applicable - groundwaters have been investigated, and monitored - this will be continued
R308	Aquatic environment - pre-operational monitoring	Applicable - Big Brook was surveyed for aquatic resources on 4 July 1990
R309	Environmental data - processing	Applicable - will be in accordance with NB Power standard procedures

TABLE B-2

Application of Construction Phase Guidelines

Guideline Number	Subject	Application
401	Erosion and siltation control - scheduling of construction	Applicable - refer to Section 6.1.1.2
402	Erosion and siltation control - clearing practices	Applicable - refer to Section 6.1.1.2
403	Erosion and siltation control - grubbing	Applicable - refer to Section 6.1.1.2
404	Erosion and siltation control road building	Applicable - refer to Section 6.1.1.2
405	Erosion and siltation control - stripping, grading and excavation	Applicable - refer to Section 6.1.1.2
406	Erosion and siltation control - surface drainage control	Applicable - refer to Section 6.1.1.2
407	Erosion and siltation control - dredging and in-water construction	Not applicable - there will be no dredging, or in-water construction
408	Wastewater minimization	Applicable - refer to Guideline R208
409	Wastewater discharges and spills - effluent quality	Applicable - refer to Guideline R211
410	Wastewater discharges and spills - control procedures	Applicable - a spill response plan will be available, refer to Section 7.6.2.2 and 7.6.2

.....continued/

TABLE B-2 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
411	Wastewater discharges and spills - oil, fuel and chemicals storage	Applicable - refer to Sections 3.4, 3.6, and 7.6.2.2
412	Wastewater discharges and spills - refuelling	Applicable - equipment will only be refuelled at dedicated and approved facilities
413	Waste containment and disposal - solid wastes near watercourses	Applicable - slash and debris will not be temporarily or permanently stored near watercourses
414	Waste containment and disposal - solid waste disposal site	Not applicable - solid waste will not be disposed of at the site
415	Waste containment - seepage control criteria	Applicable - refer to Guideline R210
416	Waste containment and disposal - management of solid waste disposal sites	Not applicable - hazardous wastes will not be disposed of at site
417	Waste containment and disposal - management of disposal site	Not applicable - no solid waste disposal sites will be necessary for the power plant
418	Air pollution control - fugitive dust emissions	Applicable - refer to Section 6.1.1.2
419	Air pollution control - combination sources	Applicable - refer to Section 7.1

.....continued/

TABLE B-2 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
420	Air pollution control - domestic garbage and odours	Applicable - domestic refuse will be stored in proper containers and routinely transferred to regional disposal sites
421	Noise control - intensity limitation	Applicable - construction phase noise will meet the guideline limits, refer to section 6.1.1.2, 7.3, 4.6
422	Noise control - scheduling of activities	Applicable - nighttime construction work will be scheduled to ensure achievement of noise level criteria, refer to Section 6.1.1.2
423	Terrestrial and aquatic life protection - terrestrial life	Applicable - the site does not include critical wildlife habitat - refer to Sections 7.3.3, 4.2.1.6, 6.1.2.1
424	Terrestrial and aquatic life protection - aquatic life	Applicable - construction of the power plant will not involve disturbances to aquatic habitat.
425	Archaeological and historical resource protection	Not applicable - archaeological and historical resources are not located at or near construction areas (refer to Section 5.6.8)

.....continued/

TABLE B-2 (continued)

Application of Design Phase Guidelines

Guideline Number	Subject	Application
426	Construction contracts - environmental requirements	Applicable - environmental specifications are included as standard practice in NB Power construction contracts
427	Environmental audits	Applicable - standard NB Power procedures will apply
428	Monitoring and Reporting	Applicable - NBDOE approvals require the routine reporting of monitoring data

APPENDIX C
CONTINGENCY PLAN

General Notification Procedures

NB Power Operations Superintendent or his designate on duty will notify:

For all land based spills:

Regional Environmental Inspector
NB Department of Environment
Chatham, NB
(506) 773-6032 (O)

For all spills involving the Miramichi River:

Canadian Coast Guard Vessel Traffic Centre Emergency Number
1-800-565-1633
(Zenith 40000)

This first call will alert the relevant government agencies so that officials can be dispatched to monitor clean-up efforts and offer assistance if necessary.

The Superintendent will contact the Central Technical Services Division via NB Power's 24 hour dispatch service and initiate the internal notification of the spill.

This general notification procedure of government and internal officials for all spills both on and off NB Power property is functional 24 hours a day.

A description of the contaminant in and volume of the spill and also the location and source of contamination will be reported to all agencies.

If the spill is off NB Power property and does not involve NB Power equipment, personnel or supplies, NB Power will enact the previously discussed notification procedures only unless otherwise directed.

In the event of a fuel spill on NB Power property, NB Power will take immediate action to contain and clean-up the contaminant and will have ultimate responsibility to ensure proper removal and disposal of the contaminants. The Canadian Coast Guard and NB Department of the Environment will monitor the effectiveness of the clean-up efforts and will intercede only if their assistance is requested or if NB Power fails to respond adequately.

Upon notification of an accident on NB Power property, the NB Power Operations Superintendent or on-scene commander will oversee:

- the immediate prevention of additional spillage;
- direct the use of needed resources;
- notification of appropriate NB Power and government officials;
- removal or treatment of contaminated material including soil;
- proper disposal of contaminant, soil, adsorbents, disposable booms and clothing, and
- restoration of the accident site.

With the occurrence of a minor spill, NB Power will have the personnel and equipment or contractors available to clean-up the contaminant and restore the location to its prespill conditions. Current policy is to clean-up very minor on-site spills of 50 litres or less first and to contact the appropriate government agency after completion of the operation. In the event of a major spill, NB Power will use its own resources and private consultants to the fullest extent and then request assistance from relevant government agencies.

Internal and Industrial Resources

NB Power will have equipment available at the Millbank location at the NB Power Chatham Plant to contain and clean small spills.

Local industrial contacts who are able to assist in clean-up operations include industrial environmental and heavy equipment contractors and the local affiliate of the Petroleum Association for the Conservation of the Canadian Environment (PACE).

The PACE Cooperative in Newcastle, NB has equipment which can be rented short term and offers equipment training sessions.

Government Resources

The Canadian Coast Guard can also provide equipment or assistance if necessary. The Newcastle and other regional offices all have equipment available locally.

The on-scene commander or assisting government agency can also contact any of the following agencies if their assistance is necessary.

FIRE EMERGENCY:	Douglastown Fire Department (506) 622-1224 (24 hr service)

This number contacts the Newcastle dispatch who will alert:

1) Douglastown Fire Department
2) Chatham Fire Department as back-up
3) Newcastle Fire Department if necessary

POLICE EMERGENCY: Royal Canadian Mounted Police
Newcastle, NB
1-800-322-3974 (24 hr service)

They will contact:

1) Chatham Town Police if necessary.

Media Contact

During any emergency, the media will be notified if they are not already present at the scene. NB Power should have an employee available for acting as a contact with the media. They will be responsible for keeping the media at a safe distance from the accident scene and providing them with facts and any evacuation information about the incident.

Communication of Plan

All employees participating in clean-up operations will be trained, as discussed previously, in emergency operations and safety procedures as outlined in NB Power's General Operation and Maintenance Procedure No. 42. Each employee will also be informed of exactly what their responsibilities are during the emergency. Copies of the plan will be circulated to those employees and officials who may be involved in clean-up and monitoring operations. They will also be informed of any amendments such as phone numbers, names and equipment changes which occur. NB Power will have an employee available whose responsibility is to update the plan when necessary and communicate the changes.

Simulation exercises to coordinate actions and responsibilities and to improve response capabilities, training and equipment handling will be provided. They will be used to coordinate dissemination of information between the on-scene commander and other employees via use of mobile phones, walkie talkies or whatever form of verbal communication NB Power has available for emergency operations.

These exercises will also be used to check the operational ability and accessibility of equipment designated for clean-up operations.

Contaminated Waste Disposal

NB Power is ultimately responsible for properly disposing of contaminated fuel and disposable equipment and apparel. Contaminated soil will be treated either through bioremediation in-situ, or through incineration at an approved facility.

Restoration

NB Power is responsible for restoring the contaminated site to its previous state and for dispensing compensation if necessary. The work will be monitored by either the NB Department of Environment for land based spills or the Canadian Coast Guard for spills contaminating the Miramichi. NB Power can contact the acting lead government agency for assistance and recommendations or they can contracts specialists to complete the restoration.

Monitoring of Clean-Up

The clean-up of every spill reported to or sited by government officials will be monitored by either the NB Department of Environment for land based spills or the Canadian Coast Guard for water based spills. Both agencies will act as lead government agency and will only assist if requested by the contaminator or if the contaminator is negligent in his operations.

Report Filing

NB Power has developed an Environmental Contingency Report form to be completed in the event of a spill. This report details the spill occurrence, actions taken and conclusions and recommendations. The report is filed by the person acting as Environmental Coordinator at NB Power. Copies are sent to Environment Canada, NB Department of Environment and to NB Power's Environmental Control files.